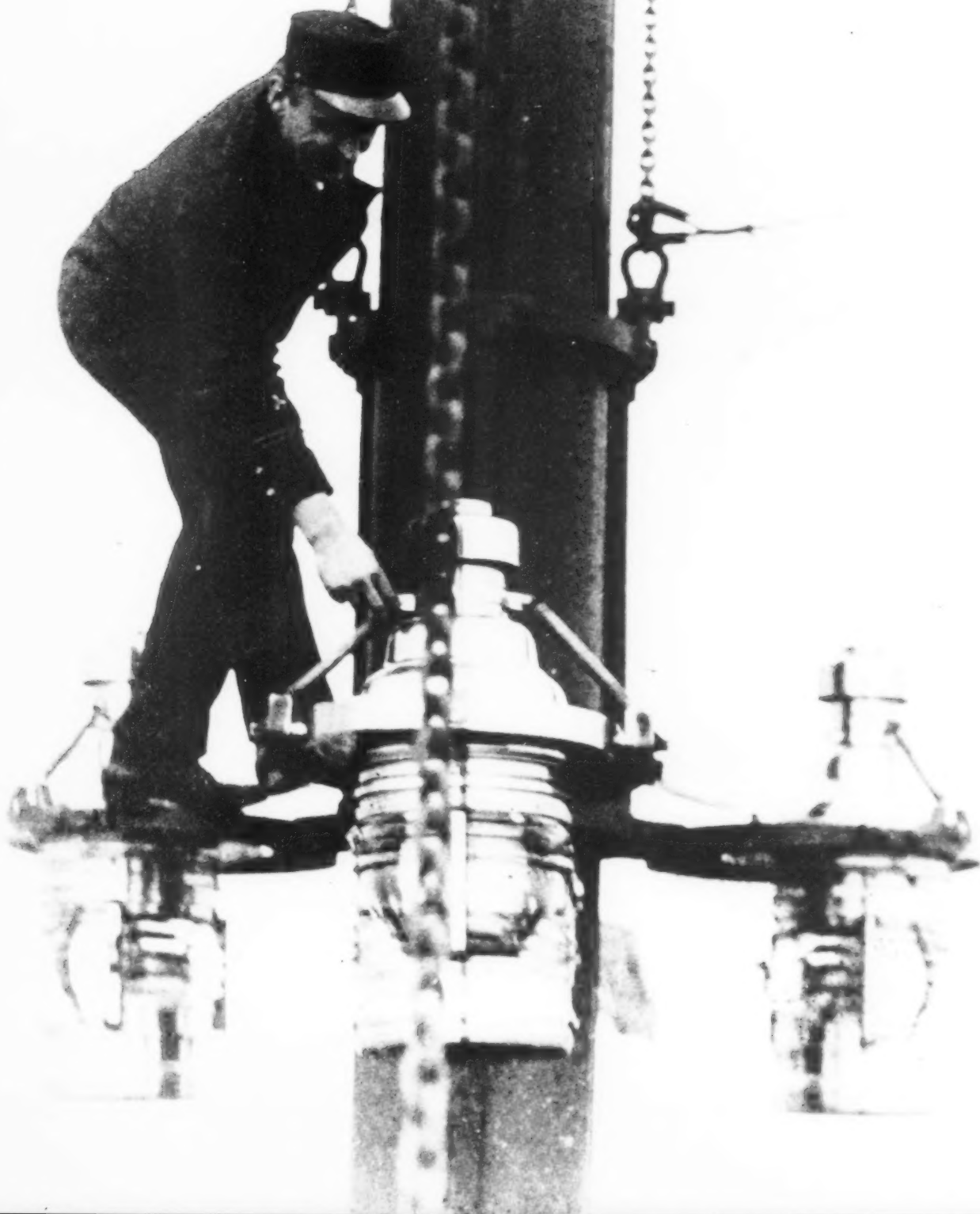


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# Mariners Weather Log

Fall 1994



# South Bass Island Light

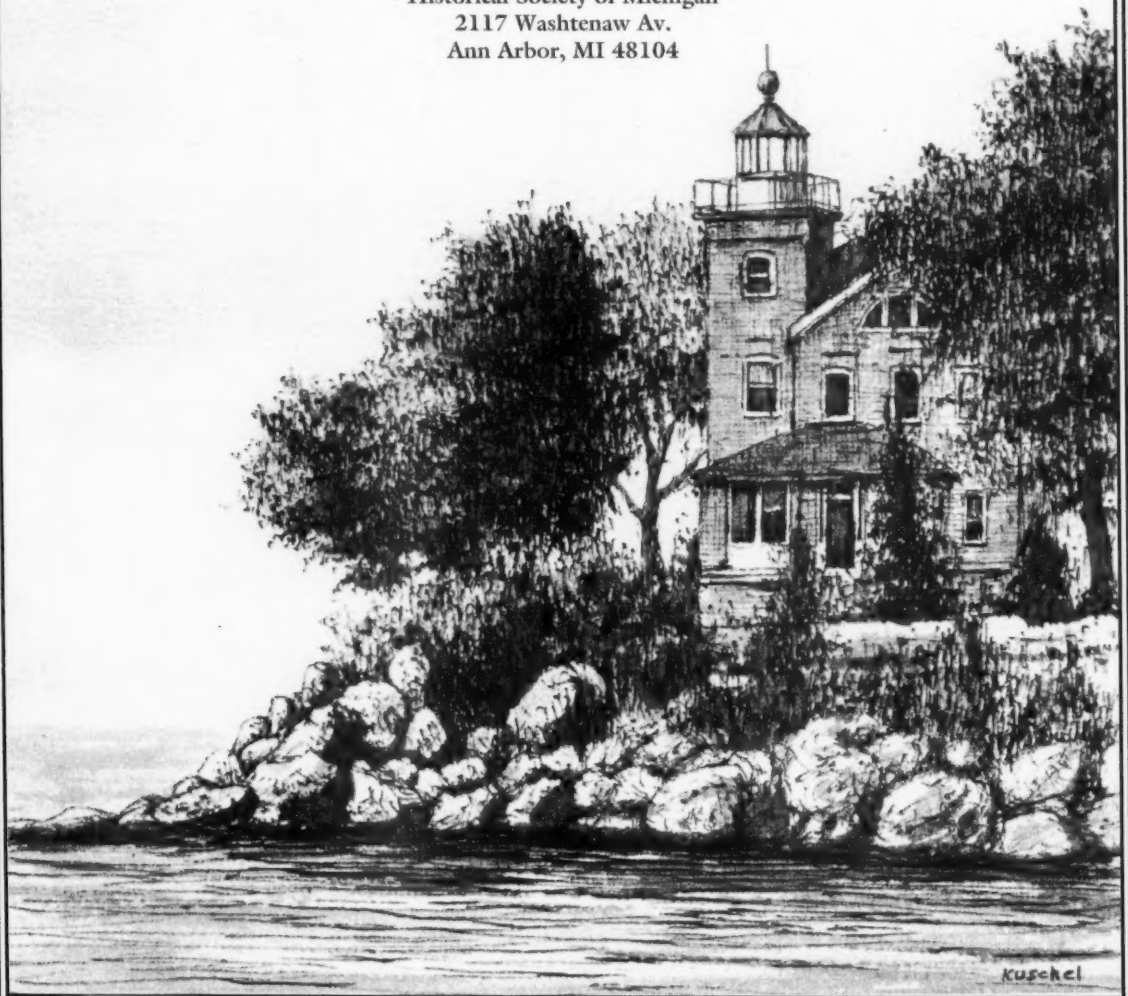
Lake Erie  
Off Port Clinton, Ohio

One of the most popular regions in the Great Lakes is Put-In-Bay in Lake Erie. Our friends, Gary Smith and Sharon Doyle, leave from the Detroit area many times during the summer to sail to Lake Erie's western basin and the twenty-five islands that dot this region. They very often end up at South Bass Island. They return with many tales and history for us - along with some of the fine wine produced in this area!

Another friend, Ronald L. Stuckey, Professor of Botany at Ohio State University, spends time on the Island. The University has a 30-year lease on it after which it will become the permanent owner, meaning that it may become the only university in the country to own a lighthouse. A few years ago, Prof. Stuckey discovered a new plant species that was named after him. [See Mailbag for plea concerning South Bass Island and Stone Slab Light.]

*Pen and Ink Drawing by Leo Kuschel*  
*Descriptive passage by Leo and Sue Kuschel*

Historical Society of Michigan  
2117 Washtenaw Av.  
Ann Arbor, MI 48104



# Mariners Weather Log



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## Tale of Two Sorties

LT. William Schulz and Mr. Patrick Dixon

*The Navy's attempt to outwit Hurricane Emily*

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## Lightships: Sentinels of the Sea-Lanes

Willard Flint

*Part one of a two-part series on the history of U.S. Lightships*

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## Western North Pacific Typhoons— 1993

Staff, Joint Typhoon Warning Center

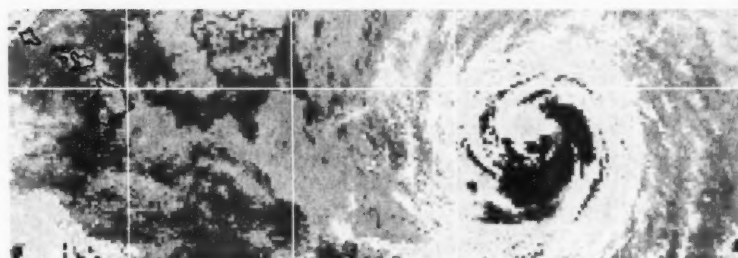
*Greatest total number of tropical cyclones since 1967*

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## Maritime Institute of Technology & Graduate Studies

Nancy O'Donnell

*Mariners return to school to keep abreast of technology*



Hurricane Fernanda— see Hurricane Alley page 62

**Cover:** The old lamplighter — crewman from *Shovelful Shoals* Lightship #3, circa 1913, inspects the ship's oil-powered lights, 12 meters above deck. The shoals are located about 1/2 mile off Monomoy Point, Massachusetts, at the eastern end of Nantucket Sound.

**Inside Back Cover:** Skipjack *H.M. Krenz* on the Chesapeake Bay, from Lucian Niemeyer's *Chesapeake Country* exhibition. On exhibit at the Mariner's Museum in Newport News, Virginia from November 18, 1994 through March 12, 1995.

**Back Cover:** On May 24, 1994 Maritime Administrator Albert J. Herberger unveiled a new flag designed to honor America's civilian seafarers who have supported the Nation's armed forces in times of war and carried its commerce in peacetime. The flag was designed by the U.S. Army's Institute of Heraldry. It is shown here displayed by two midshipmen at the Merchant Marine Memorial Service.

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## Mariners Weather Log



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The Secretary of Commerce has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through July 1, 1995.

The *Mariners Weather Log* (ISSN:0025-3367) is published quarterly by the National Oceanographic Data Center, National Environmental Satellite, Data, and Information Service, NOAA, Washington DC 20235 (telephone: 202-606-4561). Funding is provided by the National Weather Service, NOAA. Data is provided by the National Climatic Data Center, NOAA.

Articles, photographs and letters  
should be sent to:

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## A Rose By Any Other Name

**T**o old timers, such as myself, the National Weather Service will always be the Weather Bureau. Sometimes these lapses can lead to problems such as in the last issue when I called the National Ocean Service, the National Ocean Survey. Maybe that will always be Coast and Geodetic Survey to some people, but I must apologize for that mistake. If we live long enough things may come full circle. This appears to be the case with the VOS group which has moved from the Office of Systems Operations to the Office of Meteorology of the National Weather Service. This refers to Vince Zegowitz and Marty Baron. The Port Meteorological Officers are in separate regions. Unfortunately, the *Mariners Weather Log* was not included in this transfer. That would have been too logical. While this move may not seem like anything but an administrative detail, it could have long range implications for the mariner from my viewpoint. It combines the marine observation program with the marine warning and forecast program and along with the evolution of the Marine Forecast Branch is another indication of the National Weather Service's commitment to the marine program. It seems that the mariner is no longer taking a back seat to the aviator. Changes in the VOS telephone numbers are listed in the back of the *Log*. One other apology is due from the last issue, when we inadvertently renamed the Great Britain Hydrographic Office, the Hydrology Office. The Hydrographic Office is part of the Ministry of Defence and has been in existence a lot longer than any of our services, so there was no excuse for this blunder.

On the brighter side, the last issue was fairly successful. A lot of people are interested in the new communications systems, and we also got a good response on the Internet information. Hopefully in the future we will be able to run more information on Internet. We also heard recently that the Navy/NOAA Oceanographic Data Distribution System (NODDS) may go to Internet. This would be a real boon to the mariner. NODDS was developed by the Navy's Fleet Numerical and Oceanography Center in Monterey, California to provide Department of Defense users throughout the world with direct access to environmental information in a digital form. Right now NODDS is a client/server type of system operating as an online service. The client gets to define areas of interest anywhere in the world and then picks from a menu. The products include synoptic observations, satellite images, high seas and tropical cyclone warnings, and analyses and forecasts produced by numerical models and available as gridded fields. Once the user has defined the area of interest and the products desired, the system automatically dials the appropriate telephone number in Monterey, logs onto the host data base server, downloads the data and hangs up the phone. The client software then provides options for displaying the data. For more information on this service in its present form, please contact the Chief, NOAA Ocean Applications Branch, 7 Grace Hopper Street, Monterey, CA 93943. We hope to have an article on the NODDS system in the next issue.

We just received word at press time that former British PMO Mike Coombs died. Captain John Houghton of the Marine Observer was kind enough to drop us a line. Please see page 65 for details.

Dick DeAngelis



*These photographs were taken after the 1926 storm that hit Miami, Florida. Left: This yacht was originally owned by Germany's Kaiser Wilhelm. Below: Most of the Model Ts in this used car lot were damaged.*



## **Florida Hurricanes and Tropical Storms 1871-1993: An Historical Survey**

*Fred Doehring, Iver Duedall, and John Williams*

Did you know that the names of severe hurricanes, such as Andrew in 1992, are retired? Can you name the earliest hurricane to arrive during any hurricane season (Alma, June 1966), or the year in which storms were first given names (1953)? The answers to these and hundreds of other questions about the storms that have ravaged Florida during the past 122 years are now available in *Florida Hurricanes and Tropical Storms 1871-1993*.

This 116-page book also traces the history of Florida's hurricanes and tropical storms using data ranging from satellites to personal letters of people who lived through the storms. Arranged by decades, the authors discuss the meteorological significance associated with these storms, the damage they caused and interesting and often little-known facts about them.

The book includes photographs from newspapers dating back to the early 1900's showing damage to downtown Miami, trains swept off of their tracks, sunken ships and more. There is also a section with plates tracking the storms in 10-year increments.

Even the novice hurricane tracker will be delighted by the information found in this book. The most basic information, such as how and where Florida's hurricanes develop is presented along with insight into the role that technological improvements have played in preparing communities for these storms. Overall, it is a detailed compilation of all the major storms to reach Florida during the last 122 years.

To Order: Send a check or money order for \$5.00 payable to the University of Florida (Florida residents must add 6% sales tax). Send to: Florida Sea Grant - Publications - P.O. Box 110409 - University of Florida, Gainesville, FL 32611-0409.



*Hurricane Emily Threatens the Atlantic Fleet*

## Tale of Two Sorties

LT. William Schulz and Mr. Patrick Dixon  
Naval Atlantic Meteorology and Oceanography Center





**W**hen a hurricane threatens the U.S. mainland, civilian mariners look to the National Weather Service or a private weather agency for up-to-date information and guidance. Civilians listen to the media, NWS, and their local Disaster Preparedness Office. The United States Navy's Atlantic Fleet, with billions of dollars in assets at risk, relies on OTSR (Optimum Track Ship Routing) and fleet forecasts provided by the Naval Atlantic Meteorology and Oceanography Center (NAVLANT-METOCEN) in Norfolk, Virginia.

During the 1993 Atlantic hurricane season, Hurricane Emily provided a major challenge to the OTSR team and the Commander in Chief of the Atlantic Fleet (CINCLANTFLT). Emily's movement threatened two major naval installations on the East

Coast—Charleston, South Carolina and Norfolk, Virginia. With two large concentrations of naval vessels as potential targets, and the cost of sortieing each port well over \$1 million, OTSR maintained close contact with the National Hurricane Center (NHC) as well as Navy, Coast Guard and Military Sealift Command assets along the eastern seaboard as the decision to evade or remain-in-port was being made.

OTSR becomes an especially critical fleet service during the Atlantic hurricane season. The OTSR team, composed of one civilian and four military ship routers, is tasked to provide initial track recommendations to vessels planning voyages in excess of 1500 nautical miles. OTSR focuses on safety with an eye towards fuel and transit time economy, based on the maximum head, beam, following seas, and true winds that the individual master or Commanding Officer has

## SORTIE COSTS

	FUEL/DAY	HARBOR SERVICES
CARRIER 	\$ 84,000	\$ 8,000
DESTROYER 	\$ 18,720	\$ 2,200
FRIGATE 	\$ 8,600	\$ 2,200
SUBMARINE 	-----	\$ 2,200

### National Hurricane Center 1982-1991 Forecast Average Error

(After Lawrence and Gross, 1993)

72 hours - 309 miles  
48 hours - 206 miles  
24 hours - 104 miles  
12 hours - 54 miles

stated to be their limits. Additionally, OTSR maintains around-the-clock weather surveillance for Department of Defense and civilian-contracted vessels. When heavy weather threatens, be it a North Atlantic winter storm or a tropical cyclone, OTSR provides warnings and evasion recommendations directly to the individual vessels. For tropical systems, these warnings consist of a rebroadcast of NHC's 6-hourly warnings over military communications channels, followed by an evasion recommendation based on NHC's official storm track and known or suspected error radii. Finally, as a tropical cyclone threatens a naval port, OTSR provides sortie-decision and evasion recommendations to port authorities.

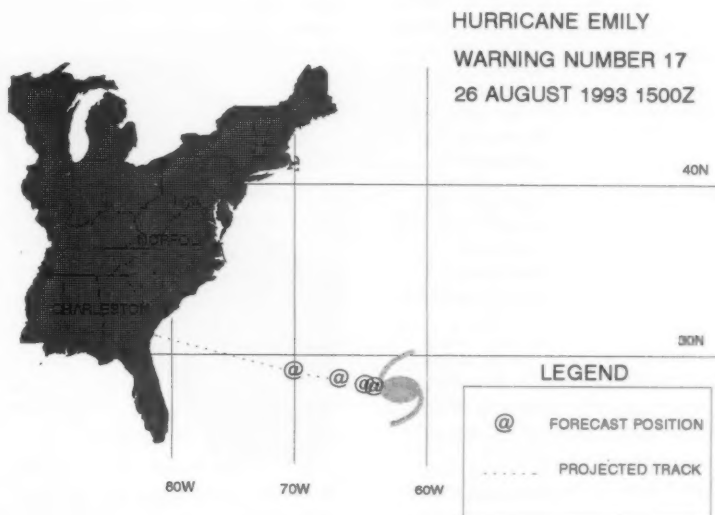
The difficult choice of staying in port and riding out an approaching hurricane, or getting underway in advance of the system's arrival, is often a subjective one made by the military Senior Officer Present Afloat (SOPA) or other local commanders. Getting a group of ships underway involves spending a great deal of money and manpower in fuel, harbor services and disrupted work schedules (chart

above). Crucial to the evasion scheme is departing at the right time, especially in ports like Norfolk and Charleston, where evasion options are limited. A major factor in this process is having enough confidence in the forecast of the hurricane's track to make an economical, safe decision in a timely manner. Leaving port may expose vessels and crews to damaging winds and seas. On the other hand, staying in port means risking damage by high winds and storm surge if the forecast is in error and the port is damaged.

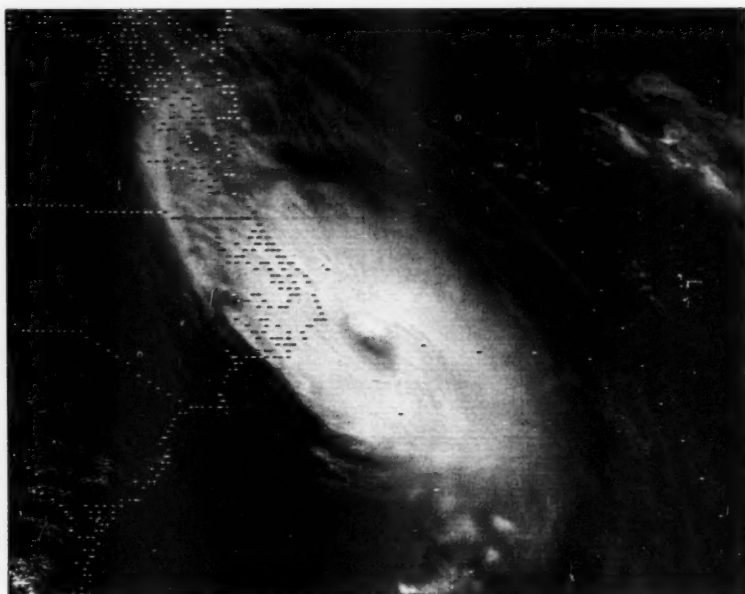
### Emily

The cloud cluster that was to become Hurricane Emily was designated Tropical Depression Number 5 on August 22, 1993, several hundred miles east of the Windward Islands. Four days later, the system strengthened and was classified as Tropical Storm Emily. On the afternoon of the 26th, the winds had increased enough for the NHC to upgrade Emily to a hurricane.

Extrapolating Emily's track on August 26 (below) indicated landfall near the Georgia/South Carolina border. Extended fore-



*The Portsmouth Naval Shipyard (page 4) was clobbered during the hurricane of August 23, 1933 as seen in this shot of the top of the pier. The tide at Norfolk rose 2.1 meters (7 feet) above normal to produce one of the worst floods in its history. National Weather Service photo.*



casts indicated a series of short-wave troughs would move eastward off the continental U.S. during the following week, but their effect on Emily's track was not easy to determine. Ships underway and in port along the U.S. East Coast began to seriously consider their evasion options.

## Charleston, SC

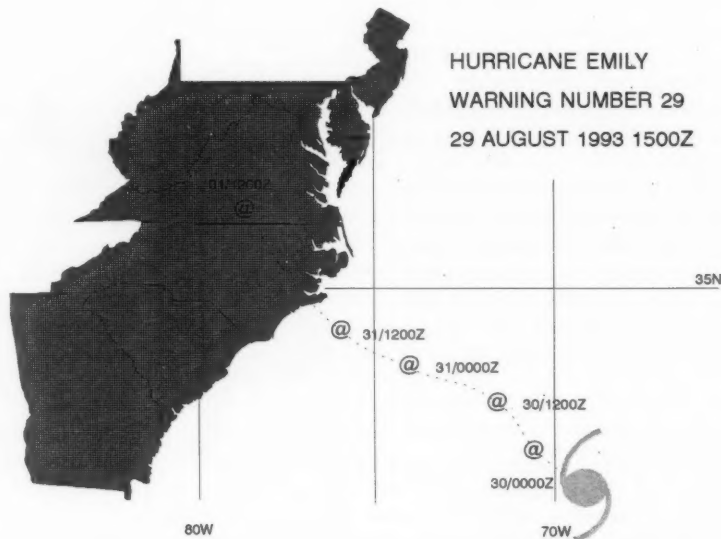
The Charleston, South Carolina Naval Base was the first major naval installation threatened by Emily. On Friday, August 27, OTSR ship routers were in contact with Navy forecasters in Charleston and operational commanders in

South Carolina discussing the possibilities of sortieing the port. In the event of a sortie, 19 ships would leave the harbor, while 15 smaller vessels or those not materially able to get underway would remain in port.

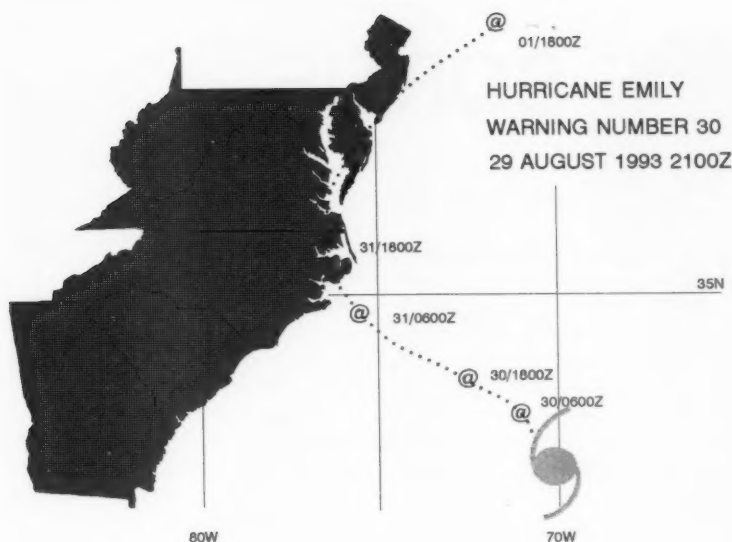
NHC predictions continued to show the hurricane moving west northwestward, yet each subsequent forecast projected the storm's course slightly more to the north than the previous advisory. Charleston continued to fall within the error radius of storm-force winds. On Friday afternoon, after a sortie conference, the tentative time to depart from Charleston was set for 0900 LST, Sunday, August 29.

From August 27 to 30, a short wave trough and ridge passed to the north of the system, turning the track toward the northwest and then westward. Late on August 28, NHC predictions indicated that landfall would be well north of Charleston, near the South Carolina/North Carolina border, as track projections continued to move the landfall point northward up the coast. OTSR recommended that vessels in

*Hurricane Emily (above) approaches the Outer Banks of North Carolina on the 31st of August at about 1900 UTC. Emily was the year's first, strongest and longest-lasting hurricane. Even though it recurved, a portion of Emily's eyewall moved across Hatteras Island. Strongest winds near the surface were measured at Diamond Shoals Light Tower, which recorded 89-knot sustained winds with gusts to 128 knots.*



HURRICANE EMILY  
WARNING NUMBER 29  
29 AUGUST 1993 1500Z



Charleston remain in port (but on standby) until at least Sunday afternoon, August 29, since the hurricane seemed to be on a more northwesterly course, and any storm surge in Charleston would be minimized by offshore winds.

At 0430 LST on Sunday August 29, Navy forecasters in Charleston were again conferring with OTSR ship routers about the sortie execution planned for that day. With an approaching tidal window at 1400 LST (some ships in Charleston need slack water to negotiate a bridge before heading to sea), OTSR continued to advise remaining in port. Fortunately, the 1400 window allowed another official track prediction from NHC to be factored into the decision-making process. The 1100 LST warning on the 29th projected landfall near Wilmington, North Carolina (left). This continued northward trend combined with the coordinated Navy Charleston forecasters/OTSR recommendations resulted in a decision, rendered late on Sunday morning, to remain in port. Estimated savings due to the cancellation of the 19-vessel sortie was over \$200,000.

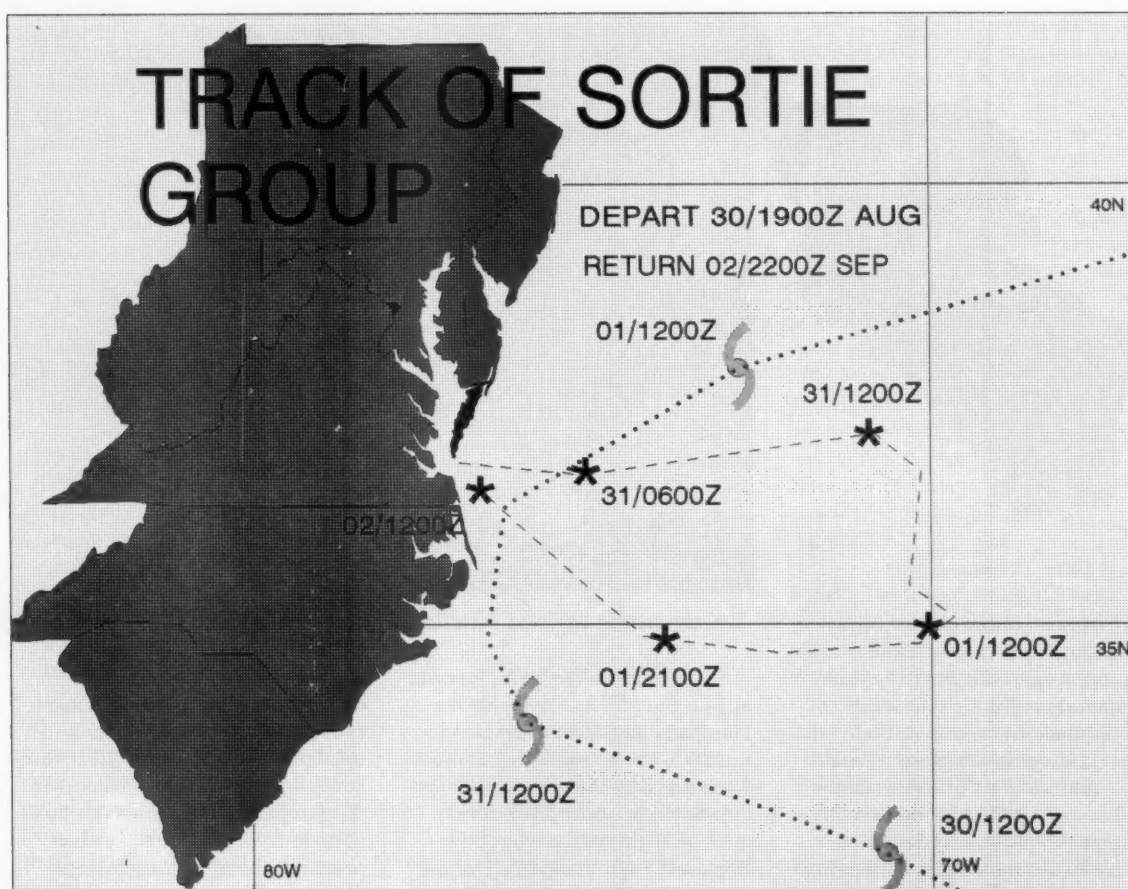
### Recurvature toward Norfolk

Charleston's good fortune appeared to be bad news for the Hampton Roads area. By Sunday the 29th, the continued northward movement of Emily, an approaching upper level trough and the slight weakening of the Bermuda High made track predictions of Emily very tenuous. Post-storm reconstruction showed that the hurricane was approaching the point of recurvature, the single most difficult portion of the track to predict. The official NHC forecast at 1700 LST on the 29th, projected Emily crossing just south of Cape Hatteras, North Carolina early on Tuesday, August 31, with sustained 85-knot winds gusting to 105 knots, then proceeding nearly due north through Hampton Roads later on Tuesday (above). Clearly, the track models were now predicting recurvature of the storm, but not until it had a chance to push through the Norfolk Naval Station.

OTSR and the NAVLANT-METOCEN watch teams began fielding a nearly steady stream of phone calls from area commands

concerned with just what havoc Emily would inflict on the local area. Navy Group and Squadron commanders requested information for their sortie preparations, aircraft commanders initiated pre-evacuation plans, and facilities coordinators, including the Commander, Naval Base Norfolk, began procedures to secure the world's largest naval installation for severe weather. Monday morning even saw a CBS-TV news crew interviewing NAVLANTMETOCEN's Commanding Officer about local preparations for Emily.

Coordination meetings for a proposed sortie from Norfolk began early on Monday the 30th. Commander, Amphibious Group TWO was designated as the sortie commander, and remained in constant contact with OTSR personnel while preparing the sortie track. The sortie decision looked clear-cut: an approaching Category II hurricane which would strengthen to a Category III before landfall; several large sail-area vessels (amphibious assault ships and aircraft carriers) in port; and no protective hurricane anchorages available. The reference publication *Hurricane Havens Handbook for the North Atlantic Ocean* (NAVENVPREDRSFCHFAC TR 82-03) advises "none of the harbors in the Norfolk area are safe havens during hurricane force winds," and further recommends "take action at an early stage in a threat situation." [For a summary of this chapter see *Mariners Weather Log* Vol. 25, No. 5, September-October 1981.] In view of the threat from Emily, a partial port sortie of 14 ships was ordered, including all large sail-area vessels not in the midst of prohibitive maintenance and capable of getting underway. Ships that remained in port were repositioned by the harbor master to avoid "nesting," thereby minimizing any damage to masts and radars caused by ships rocking



together in heavy seas.

With track predictions late Monday morning still forecasting Emily's passage over the Outer Banks of North Carolina and Cape Henry, OTSR issued a route recommendation for the Norfolk sortie group to evade at sea by departing Monday. The USS *Wasp* (LHD 1) took charge of the group of 14 ships and moved eastward, allowing Emily to pass safely west and north of the group. Additionally, one aircraft carrier and several submarines left Norfolk to avoid the storm.

As the sortie group steamed in the Virginia Capes Operating Areas, Emily's track slowly veered toward the north northeast, clipping the Outer Banks and sparing the Norfolk Naval Base

even gale force winds (above). Sortie units, after consulting with OTSR, adjusted their track as the hurricane passed by, then returned to port Wednesday afternoon.

## Epilogue

From the weatherman's viewpoint, the final outcome was disappointing — the forecast for Norfolk was a bust — when Emily passed approximately 45 miles farther to the east. However, from a safety and readiness perspective, the challenge provided by Hurricane Emily was a success, as no weather damage to Atlantic Fleet resources was reported. The recommendations and forecast support provided by the

NAVLANTMETOCEN watch teams and OTSR were greatly appreciated by sortie commanders and throughout the fleet.

In a personal letter to Captain D.A. Roman, Commanding Officer NAVLANTMETOCEN, Vice Admiral J.P. Reason, Commander Naval Surface Force, U.S. Atlantic Fleet stated, "The recent threat to the Fleet and shore facilities posed by Hurricane Emily was met with a timely and professional response. Please extend my appreciation to your military and civilian personnel who dedicated long, diligent hours ensuring the safety of our Fleet."

After all, the final measure of a forecasting center's success is customer satisfaction.



## Loss of the *Henry Cort*

Skip Gillham  
Vineland, Ontario

**L**ate season navigation often brings grief to Great Lakes steamers. The *Henry Cort* was no exception, but December was an especially unlucky month for the vessel.

The ship of whaleback design was launched as the *Pillsbury* at West Superior, Wisconsin on June 25, 1892. It went to work for the Minneapolis, St. Paul and Buffalo Steamship Co. a division of Soo Line Railroad. The ship sailed between Gladstone, Michigan and Buffalo, New York, carrying bagged flour and other package freight.

The 102-meter vessel joined the Bessemer Steamship Co. in 1896 as the *Henry Cort* and was

converted for the transportation of iron ore and coal. It joined the Pittsburgh Steamship Division of United States Steel on its formation in 1901.

On December 17, 1917, the *Henry Cort* was performing icebreaking chores on western Lake Erie when it crashed head-on with the *Midvale* and sank in 9 meters of water. The hull was not salvaged until September 22, 1918, and it was then repaired at Conneaut, Ohio.

Almost a decade later, in early 1927, the *Henry Cort* was again involved in icebreaking. This time the freighter stranded on Colchester Reef and was abandoned. It returned to service on June 29, 1927, under new ownership and

with the addition of two deck cranes, was often used to transport finished or scrap steel.

In December 1933, the *Henry Cort* was holed on Ballard's Reef, and following salvage and a trip to Detroit, the ship settled on the bottom at its dock.

Finally, on December 1, 1934, this vessel became a total loss when it hit the north pier at Muskegon, Michigan while inbound seeking shelter. Fifty-knot winds whipped Lake Michigan as the *Henry Cort* travelled from Holland, Michigan to Chicago in ballast.

The crew huddled on board without light or heat while they waited to be rescued. Fortunately, they

had leftover Thanksgiving turkey to eat.

The U.S. Coast Guard sent a surfboat to help the stranded sailors, but their craft overturned and a rescuer perished becoming the only casualty of that ordeal.

However, this final December misadventure ended the career of the *Henry Cort*. The hull was cracked, and it was recorded as a \$75,000 loss. Its remains disappeared during World War II as part of the hunt for scrap steel.



The *Henry Cort* stranded at Muskegon. Photograph courtesy of the Milwaukee Public Library.



## LIGHTSHIPS SENTINELS OF THE SEA-LANES PART 1

**WILLARD FLINT  
U.S. COAST GUARD**

**L**ife aboard lightships was often viewed as monotonous with crews spending long days anchored offshore. This monotony was occasionally broken by periods of sheer terror. Survivors from *Five Fathom Lightship* #37, which took four men to the bottom with it, told how their ship foundered off Five Fathom Bank, New Jersey after an army of mountainous waves marched across its bulwarks, tore off its ventilators and hatch covers and filled it with water through the resulting deck openings.

There were no survivors, however, when the *Buffalo Lightship* #82, located near Buffalo N.Y. foundered in a gale that swept across Lake Erie in November 1913, but a message from its dead captain to his wife told it all. Scrawled on a board that washed

ashore a few days after the disaster, the message read: "Goodbye, Nellie, ship is breaking up fast.—Williams." Six months passed before the submerged wreck was located, more than 2 miles from its assigned station.

A diver who penetrated the 19 meters of water that enshrouded *Buffalo* #82 reported that the storm had apparently parted its cables, battered in its superstructure, then dragged it to destruction. The body of one of the six men lost with it was found a year later,

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This article originally appeared in the U.S. Coast Guard's *Commandant's Bulletin*, May 1993 in its entirety. All photographs courtesy of the U.S. Coast Guard Historian's Office.

13 miles from the site of the sinking.

Lightships have been around a little more than two centuries, though a prototype existed in the ancient world. During the last few centuries B.C., Roman coast guard galleys carried at their mastheads open framework baskets in which a fire sometimes was built, serving as a signal light. Manned by an armed crew, such vessels patrolled the Roman coasts to guide and protect incoming vessels by providing a beacon and to deter piracy by showing that a warship was at hand. But, since the prudent Roman sailor tried to avoid nighttime voyages whenever possible, the first lightships never attained the importance of their successors.

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**"Goodbye, Nellie, ship is breaking up fast."**

—Master Hugh M. Williams,  
*Buffalo Lightship #82*

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By the 18th century, however, maritime commerce had become a 24-hour-a-day undertaking, with ships ranging the entire globe. In 1731, Robert Hamblin, an Englishman, obtained permission from King George II to outfit what would become the first modern lightship. His single-masted vessel was given the name *Nore* and took up its position a year later in England at Nore Sands in the Thames estuary. Resembling a small fishing sloop, the *Nore* carried two ship's lanterns, 4 meters apart from a cross arm high above the deck wherein burned flat wicks in oil. The *Nore's* log lists several accounts of almost futile struggles to

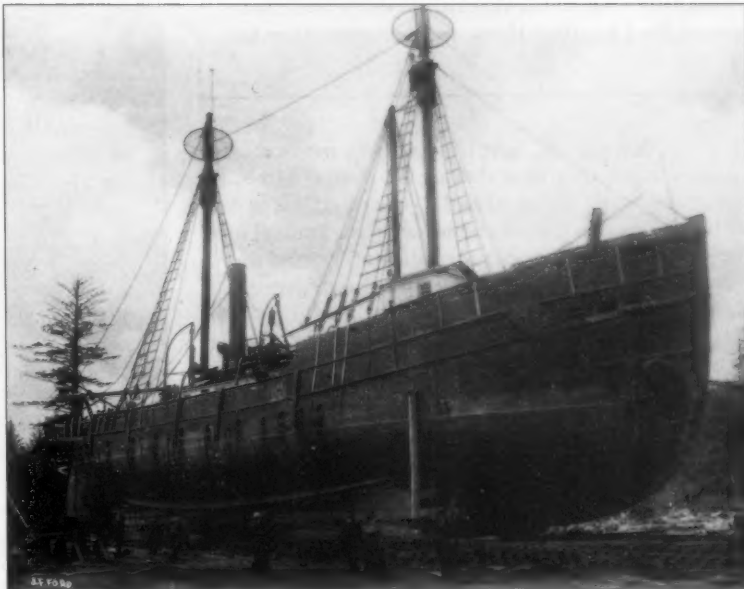
keep the lanterns lit during any appreciable strength of wind, still, ship's masters considered the lightship a godsend, and similar vessels soon entered similar service off the coasts of most every seafaring nation.

At least six lightships were in use off England's coasts before the United States even ventured into the concept of lightships. The first U.S. contract was awarded in 1819 to John Pool of Hampton, Va., for a vessel "...of 70 tons burthen, copper-fastened...a cabin with four berths, at least ... spars, a capstan, belfry, yawl and davits." Delivered in the summer of 1820, this first "light boat" was initially stationed off Willoughby Spit, Virginia, as an aid to Chesapeake Bay commerce. Storms and heavy seas, however, scourged this exposed position, and the vessel had to be shifted to a safer anchorage off Craney Island, near Norfolk, Virginia. Within a year, four more lightships appeared, marking dangerous shoals in the Chesapeake. America's first true "outside" lightship—anchored in the open sea—entered service in 1823, off Sandy Hook, New Jersey.

The lightship proved as successful on this side of the Atlantic as it had on the other. During the period 1820–1983, 116 lightship stations were established by the United States at one time or another. This figure includes those stations which were renamed and moved to a different position to better serve the same purpose, and those taken over later by Canada. The number of stations existing at any one time peaked in 1909 when 56 lightships were maintained. By 1927, 68 stations had been discontinued—replaced by light-houses or buoys, taken over by Canada or considered unnecessary.

*Left: Gray's Reef Light Vessel #57 rides at anchor off Gray's Reef, Michigan in 1914. It and two sister ships were designed for use only during the navigation season on the Great Lakes, as an experiment to avoid the costs of a permanent lighthouse. Built in 1891, they were the first U.S. Lightships to be propelled by machinery.*

*Right: The Columbia River Lightship #50 broke its moorings during a gale on November 29, 1899 and grounded off Cape Disappointment, Washington, remaining stranded as refloating efforts proved unsuccessful. Eventually a marine railway was built at the site, the ship was jacked onto a cradle and hauled into Bakers Bay, Washington. It was placed back on station August 18, 1901.*





Above: "It must have been the wind." At least that's how one mariner explained the mysterious sinking of *Milwaukee Lightship #95* on December 26, 1911 in Muskegon, Michigan. The vessel which was still at the contractor's dock was raised 3 months later. Construction was completed and LV-95 served at several locations as the *Relief Lightship* until decommissioned in 1965.

Below: A salvaged *Milwaukee Lightship #95* awaiting its first assignment.

In 1939, when the Coast Guard assumed responsibility for aids to navigation, the number of stations had been reduced to 30, and although three additional stations were established during the 1954-1965 period, the total number of lightship stations continued to decline steadily until 1983 when replacement of the *Nantucket Shoals* Lightship with a large navigational buoy marked the end of America's lightship era.

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The weather could toss the vessel about so violently that even veteran sailors became seasick. On calm days, nausea gave way to tedium...

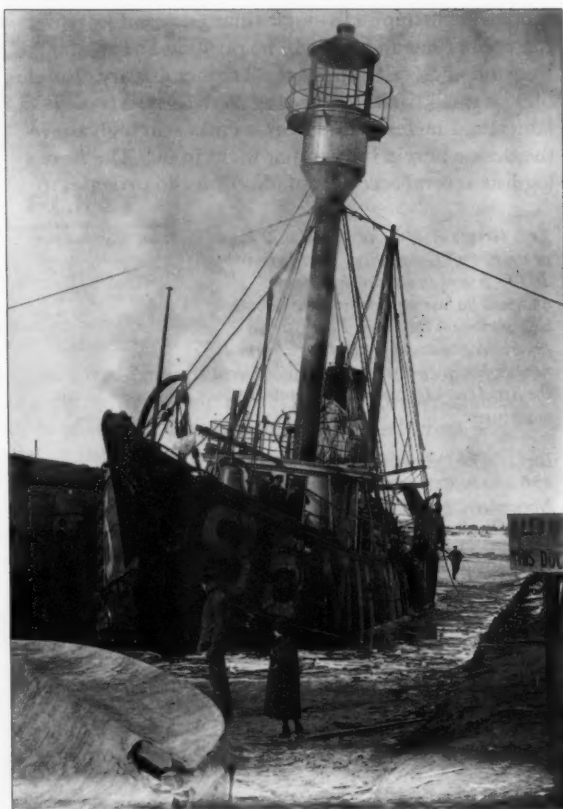
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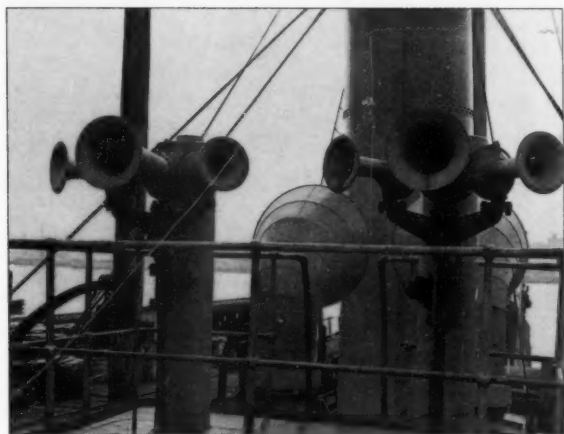
As seamarks, lightships could be moored in shallow water, even near shifting shoals where fixed structures could not be placed. They could just as easily be stationed in deep water to serve as a landfall or a point of departure for transoceanic traffic. And they could be readily repositioned to suit changing needs. In these roles, lightships served as day beacons, as light platforms by night, as sound signal stations in times of reduced visibility, and around the clock as transmitters of weather and bearing- and distance-finding electronic signals. Outages or difficulties with any of their systems and equipment could be immediately detected and remedied on the spot by the crew. During their relatively brief era, U.S. lightships evolved into highly sophisticated and efficient aids to navigation as well as excellent point sources of weather observations.

Initially, little consideration was given to suitable design and construction characteristics. Early light vessels were largely a product of opinion and arbitrary judgment on the part of builders who were often ignorant of the true purpose of the vessel or its harsh operating environment.

At first, lightships were exceedingly poor light platforms; their full body, shoal draft and light displacement combining to cause undue rolling and violent pitching. Thirty-one years after the first American lightship dropped anchor in Chesapeake Bay, the skipper of a seagoing light was complaining that "her broad bluff bow is not at all calculated to resist the fury of the sea, which in some of the gales we experience in the winter season, break against us and over us with almost impending fury." Such rolling and pitching, in turn, resulted in frequent loss of moorings and breakage or damage to the lanterns.

The captain of another such vessel described its hull as being "similar to a barrel," so that "she is constantly in motion, and when it is in any ways rough, she rolls and labors to such a degree as to heave the glass out of the lanterns, the beds out of the berths, tearing out the chain-plates, etc. and rendering her unsafe and uncomfortable."





*Above: A Cunningham air-diaphragm horn replaced many old fog signals. This signal produced sound by a disk diaphragm vibrated by compressed air.*

*Below: Music, magazines and conversation were, for years, popular ways to pass time aboard lightships when not standing watches.*

Certainly by present-day standards, crew accommodations on early lightships would have been judged uninhabitable. Even years later, in 1891, a visitor to the *Nantucket* Lightship reported on the boredom and discomfort he found there. The weather could toss the vessel about so violently that even veteran sailors became seasick. On calm days, nausea gave way to tedium, for the crew could service the light and make things shipshape within a few hours, leaving the rest of the day for making rattan baskets to sell ashore or for simply whittling away the hours. Seldom did anyone visit the ship's small library, and even ship-board food was monotonous, wholesome though it was. The most common dish was "scouse," which impressed the visitor as a "wonderful commingling of salt beef, potatoes and onions." And, in terms of tours of duty aboard early lightships, crewmembers spent 8 months of the year at sea, two 4-month stints separated by shore leave.

A visit to the *Nantucket* in the early 1970s would have produced a much different report. Scientific advances in hull design, the use of bilge keels, plus adoption of improved ballasting techniques produced more stable vessels. Not only did new hull designs reduce roll, but diesel engines also helped the captain keep his vessel headed into the wind for even greater stability. Unfortunately for some, however, the smell of diesel fuel was almost as distressing as the motion the engines helped prevent.

Over the years, creature comforts were upgraded too. Reading would become a popular pastime on lightships while radio, and later, television,

helped to dispel boredom. Cooks produced a surprising variety of meals, and the murderous 4-month tour was eventually reduced to approximately 30 days. One change, though, was for the worse, at least as far as crew comfort was concerned. The bleat of modern foghorns was so loud that anyone venturing on deck without ear protectors risked pain and deafness.

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Lightship development continued to lag far behind progress being made in Europe.

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These changes in safety practices, living conditions, and in ship and equipment design were slow in coming, and to understand why this was so, one must first understand how America's lightships were managed.

Supervisory responsibility for lightships, as well as all other navigational aids, was assigned in 1820 to the Fifth Auditor of the Treasury Department, with control being exercised through what was known as the Lighthouse Establishment—a loosely structured organization administered at the local level by the Collectors of Customs. These people operated independently, acquiring material and equipment, contracting for construction and deciding on their own what requirements were to be satisfied. They also hired and fired personnel, paid the wages and carried out or arranged for the annual inspections of existing aids to navigation. The inspection reports, together with recommendations which were based largely on personal preference and opinion, were then forwarded to the Fifth Auditor.





*Above: Vineland Sound Lightship #110, later designated WAL-532, on station near Boston in 1949. While serving at Pollock Rip on August 26, 1924, it rode out a hurricane after broach-*

*ing to, and being completely smothered several times, in boarding seas. The vessel retired from lightship duty in 1971 at age 48.*

Stephen Pleasonton, the Fifth Auditor, had no familiarity with the nature of his maritime involvement, and little interest in requirements for assisting mariners, distancing himself entirely from the events in progress. Control was exercised in singlehanded fashion by arbitrary findings based on review of the inspection reports, and by tight control of the purse strings. This resulted in a host of misguided decisions, shoddy and unsafe construction, and a system of navigational aids which was inadequate to the need, behind the times and technically inefficient.

In 1838, the situation was improved when Congress divided the Atlantic Coast into six lighthouse districts and the Great Lakes into two, each with a Navy officer assigned and a revenue cutter or leased vessel made available for conducting inspections. Inspection reports gave evidence of large-scale mismanagement and pointed out in great detail, defects in equipment, low morale, incompetence among personnel, and irresponsible performance by contractors. Although Pleasonton was apparently displeased by

these reports, he continued to sidestep any remedies and remained unduly concerned with the costs cited for improving the situation.

Lightship development continued to lag far behind progress being made in Europe. Although some standardization had been achieved, by 1842, the 30 lightships in U.S. service ranged from 40-to 230-tons burden, constructed entirely of wood, poorly rigged in many cases, and had no machinery-driven means of propulsion. Illuminating apparatus was limited to multiple-wick sperm oil lamps of poor visibility which had to be raised and lowered to the deck for servicing. Ground tackle was inadequate and hull design still failed to consider the weather and sea conditions encountered by these small vessels. Neither tenders nor relief vessels were available at the time, and, as a consequence when the vessels were frequently blown adrift, stations remained unmarked for periods measured in weeks and months.

Congress eventually became aware of the serious disarray and, using competent and qualified

inspectors, carried out an investigation in 1851. This report pointed out that many of the lightships were extensively rotted and poorly maintained; their lighting equipment inadequate; and that entire crew complements were often absent for lengthy periods. Also criticized was the practice of hiring farmers and other landsman as officers and crewmembers who, in some cases hired stand-ins to perform their duty. Much was made of the fact that the published range of visibility of all lights was erroneous; that there was no uniform system for coloring, numbering or otherwise identifying floating aids; that the positions of many lightships had been poorly selected; and that additional vessels were required.

The outcome of this report led to formation of the Lighthouse Board in 1852 as a separate branch of the Treasury Department. This nine-member committee composed of officers of the Navy, Army Corps of Engineers and civilian scientists acted at once to take advantage of available technology, to upgrade equipment and to revise contracting procedures.

The organizational structure was drastically overhauled to provide seven districts on the Atlantic Coast, two on the Gulf Coast, two on the Great Lakes and one on the Pacific Coast—each with a Navy officer as district inspector.

By 1855, this new structure had led to construction of several lightships of new, and more or less standard design, and installation of new and more efficient illuminating apparatus on most existing vessels.



*Above: On August 6, 1918 Diamond Shoal Lightship #71 (shown here as Nantucket Shoals) reported by radio the presence of a German submarine which had sunk a passing freighter. The message, warning other Allied ships, was intercepted by the submarine U-104. After surfacing and giving the lightship crew an opportunity to abandon ship, they sank the LV-71 with deck guns.*

The merits of various types of sound signals, illuminants and methods of marking or otherwise distinguishing one lightship from another were also investigated.

Until this time, lightships were identified only by the name of the station which they occupied, and no specification or requirement existed for color or marking. Although station names were painted on lightships at about this time, no numbers were used to identify individual vessels until 1867. As progress in the technical area continued, so did efforts to upgrade the caliber and competence of lightship crews. However, with the 1852 ration allowance for lightship crewmembers being set at 20 cents per day, wages, benefits, accommodations and food remained rather spartan.

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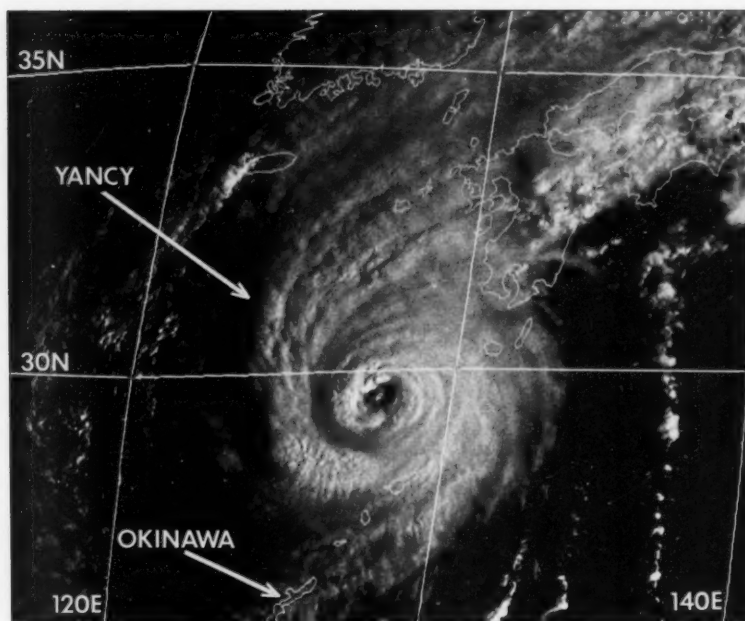
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At the district level, an engineer was assigned to assist the inspector and, as time progressed, each district established a depot for supply and maintenance of its own equipment. Modern equipment continued to be introduced, and supervision and general effectiveness was improved. There is little question that the Lighthouse Boards' progress was noteworthy, however, the committee organization did not lend itself to prompt action on day-to-day operating matters, and translating plans and recommendations into accomplishment continued to be a cumbersome process.

Congress again stepped in and feeling the need for an organization capable of functioning as an entity responsive to a single civilian authority, the Lighthouse Board was disbanded in 1910. In its place was established a Bureau of Lighthouses within the Department of Commerce, having as its operating agency the U.S. Lighthouse Service. Heading up the bureau, a commissioner of lighthouses reported directly to the Secretary of Commerce, and also directly controlled the day-to-day operations of the service. For the first time, lightships, as well as all other aspects of navigational aids, had found a place in a service-oriented organization with an adequate command structure.

*Part 2 of "Lightships" will be presented in the Winter issue of the Mariners Weather Log. It will feature the disastrous incident involving the Nantucket Lightship and the RMS Olympic—sister ship to the Titanic. Also included will be a listing of U.S. Lightships which have been preserved as museums.*

# Western North Pacific Typhoons — 1993



Staff, Joint Typhoon Warning Center  
U.S. Naval Pacific Meteorology and  
Oceanography Center West

*Super Typhoon Yancy, with a large elongated eye is captured about 7 hours prior to landfall over southern Kyushu. At this time winds were estimated at 120 knots. Visual GMS imagery taken at about 2330 on September 2, 1993.*

**T**he 1993 calendar year total of 38 significant tropical cyclones in the western North Pacific was the highest since 1967 when there were 41. This included 21 typhoons (including 3 super typhoons), 9 tropical storms and 8 tropical depressions. The year's total of three super typhoons (winds of 130 knots or more) was one short of the 24-year (1970–1993) average for western North Pacific super typhoons. Most of this year's tropical cyclones originated in the low-level monsoon trough or near-equatorial trough. Ofelia and Percy formed in the peripheral cloud band of a monsoon gyre; while Keoni formed in the trade-wind trough of the central Pacific.

El Niño conditions prevailed in the tropical Pacific during most of 1993: the sea surface temperatures of the eastern equatorial Pacific were consistently warmer than normal, and the Southern Oscillation Index (SOI) remained negative until very late in the year when it returned to near normal. From January through October of 1993, the low-level wind of the tropical western Pacific featured an eastward displacement of monsoonal westerlies. This wind pattern is commonly observed during occurrences of El Niño. In addition, the low-level westerly wind flow associated with the *Mei-yu*

(plum rains) front was more persistent than normal and lasted into August. The *Mei-yu* front is a semipermanent low pressure trough of the east Asian subtropics during spring and early summer which extends eastward from near Taiwan into the ocean area southeast of Japan. The lingering *Mei-yu* front's associated cloud band, and the impact of several typhoons, resulted in a very cool and wet summer for Japan.

**W**ith the anomalous eastward push of monsoonal westerlies, many of the year's tropical cyclones formed in the eastern Caroline and Marshall Islands, and the mean genesis location of all tropical cyclones during 1993 was south and east of normal—yet another characteristic of El Niño years. In the 24-year period,

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This summary is based on the 1993 Annual Tropical Cyclone Report prepared by the Joint Typhoon Warning Center, Guam, Mariana Islands. Our thanks to Captain James F. Etro (U.S. Navy), Lieutenant Colonel Peter A. Morse (U.S. Air Force) and their staff.

# WESTERN NORTH PACIFIC SIGNIFICANT TROPICAL CYCLONES FOR 1993

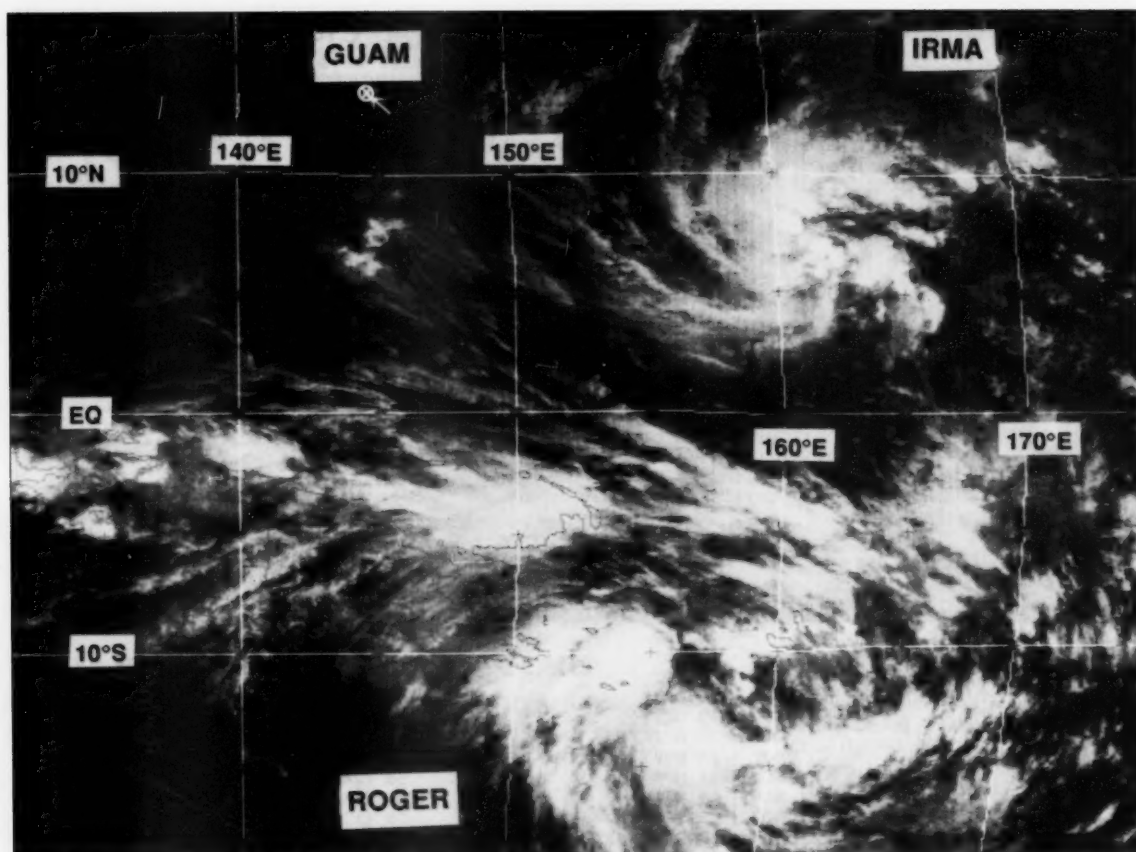
TROPICAL CYCLONE		PERIOD OF WARNING	NUMBER OF WARNINGS ISSUED	ESTIMATED MAXIMUM SURFACE WINDS KT (M/SEC)	ESTIMATED MSLP (MB)
01W	TD	01 MAR - 02 MAR	5	25 (13)	1002
02W	TS IRMA	10 MAR - 17 MAR	27	55 (28)	984
03W	TD	12 APR - 14 APR	5	25 (13)	1002
04W	TD	20 APR - 27 APR	31	30 (15)	1000
05W	TS JACK	17 MAY - 22 MAY	20	35 (18)	997
06W	STY KORYN	15 JUN - 29 JUN	51	130 (67)	910
07W	TD	17 JUN - 20 JUN	12	30 (15)	1000
08W	TY LEWIS	07 JUL - 12 JUL	23	85 (44)	958
09W	TS MARIAN	13 JUL - 17 JUL	16	45 (23)	991
10W	TY NATHAN	19 JUL - 25 JUL	25	70 (36)	972
11W	TS OFELIA	25 JUL - 25 JUL	12	45 (23)	991
12W	TY PERCY	27 JUL - 30 JUL	12	65 (33)	976
13W	TY ROBYN	01 AUG - 10 AUG	38	120 (62)	922
14W	TY STEVE	06 AUG - 12 AUG	28	65 (33)	976
15W	TD	13 AUG - 14 AUG	6	25 (13)	1002
16W	TY TASHA	15 AUG - 22 AUG	29	80 (41)	963
17W	TY VERNON	21 AUG - 28 AUG	26	80 (41)	963
18W	TS WINONA	22 AUG - 29 AUG	30	45 (23)	991
19W	STY YANCY	29 AUG - 04 SEP	26	130 (67)	910
01C	TY KEONI	20 AUG - 28 AUG	35	100 (51)	944
20W	TS ZOLA	05 SEP - 09 SEP	16	55 (28)	984
21W	TY ABE	09 SEP - 15 SEP	25	110 (57)	933
22W	TY BECKY	14 SEP - 17 SEP	13	65 (33)	976
23W	TY CECIL	22 SEP - 27 SEP	21	100 (51)	944
24W	TY DOT	23 SEP - 27 SEP	18	80 (41)	963
25W	STY ED	30 SEP - 08 OCT	34	140 (72)	898
26W	TY FLO	01 OCT - 08 OCT	30	70 (36)	972
27W	TS GENE	06 OCT - 10 OCT	15	35 (18)	997
28W	TD	07-09/12-13 OCT	13	25 (13)	1002
29W	TS HATTIE	19 OCT - 25 OCT	23	50 (26)	991
30W	TY IRA	27 OCT - 05 NOV	34	120 (62)	922
31W	TS JEANA	05 NOV - 12 NOV	30	50 (26)	987
32W	TD	18 NOV - 19 NOV	5	25 (13)	1002
33W	TD	18 NOV - 19 NOV	3	25 (13)	1002
34W	TY KYLE	19 NOV - 24 NOV	19	95 (49)	949
35W	TY LOLA	02 DEC - 09 DEC	30	105 (54)	938
36W	TY MANNY	03 DEC - 15 DEC	50	120 (62)	922
37W	TY NELL	23 DEC - 28 DEC	17	70 (36)	972

1970-1993, the mean genesis location for 1993 was the southernmost of record. That eight of the year's first nine tropical cyclones formed south of 10°N combined with the fact that none formed north of 20°N and east of 160°E, helped explain the southward displacement of the mean genesis location. The 1993 North Atlantic Hurricane season also featured this peculiar tendency for storms to form and remain at very low latitudes, impacting Venezuela, Nicaragua and Honduras. Partly as a consequence of many low-latitude (south of 10°N) formations and subsequent westward tracks, the Philippine Islands and Vietnam were impacted by a large number of tropical cyclones. The 18 tropical cyclones of the western North Pacific during 1993 making landfall in the Philippine Islands was a record.

Low-level westerly wind flow along the equator, bounded by near-equatorial troughs in the Northern and Southern Hemispheres, was a persistent wind pat-

tern (hereafter to be referred to as the twin-trough pattern) in the tropical western Pacific from late February through mid-July 1993. This wind pattern is ideal for the development of equatorial westerly wind bursts and also for the formation of tropical cyclone twins symmetrical with respect to the equator.

**D**uring March, the first named tropical cyclone of the year in the western North Pacific, Irma, formed in association with a westerly wind burst; and, along with Roger, was a classical case of tropical cyclone twins symmetrical with respect to the equator. April saw Tropical Depression 04W form in association with another equatorial westerly wind burst and was accompanied by a southern hemisphere twin that didn't mature. Tropical Depression 04W was remarkable for its long westward track, and for its inability to intensify beyond 30 knots. Jack



*Tropical cyclone twins Irma and Roger at 0030 March 12, 1993. This photograph is infrared GMS satellite imagery. By the 13th, the tropical cyclone twins (note the term "tropical cyclone twins" implies a symmetry with respect to the equator) had become mature*

*tropical cyclones heading westward and poleward in their respective hemispheres. As with other twin cyclone events, by the time the tropical cyclones had matured, the cloudiness along the equator had collapsed.*

formed in the near-equatorial trough of the Northern Hemisphere a few days after Adel had formed in the twin near-equatorial trough of the Southern Hemisphere. In mid June, Koryn formed at a very low latitude (4°N) in a low-level flow pattern which, yet again, featured equatorial westerlies bounded by twin near-equatorial troughs.

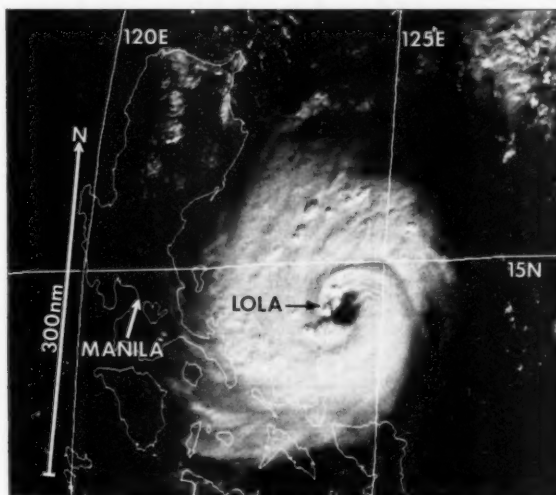
By late June, the large-scale flow pattern changed so as to resemble more closely the long-term mean wind field. In this new regime, a weak monsoon trough extended from southeast Asia into the Philippine Sea, and from there eastward into the Caroline Islands. The three tropical cyclones following Typhoon Koryn — Tropical Depression 07W, Lewis, and Marian — generated in this monsoon trough.

Nathan, developing in the eastern Caroline Islands, was the last tropical cyclone in this monsoon trough. The next major readjustment of the large-scale flow

pattern in the western North Pacific tropics occurred in late July with the formation of a monsoon gyre in the Philippine Sea. As Nathan moved west northwestward, a large monsoonal cloud band formed in the Philippine Sea in association with lowering sea level pressure there. Nathan turned northward as it neared the monsoonal cloud band. This cloud band was collocated with a band of 25- to 35-knot low-level southwesterly winds on the southeastern periphery of a monsoon gyre over the Philippine Sea. Nathan accelerated northward to a landfall over Japan. Subsequently, as the monsoon gyre moved steadily westward, two very small tropical cyclones, Ofelia and Percy, formed in quick succession at the northern end of the cloud band of the monsoon gyre and moved on northerly tracks over southwestern Japan. By the last day of July, the monsoon gyre had been absorbed into the large-scale low pressure area over eastern Asia.

**A**lso during the last week of July, pressures began to fall in Micronesia, and the monsoon trough extended from the Caroline Islands eastward to the International Dateline. During the first week of August, Typhoons Robyn and Steve formed in this monsoon trough. Robyn became a large typhoon which recurved and hit southwestern Japan. During the last 2 weeks of August, Hurricane Keoni moved across the International Dateline from the central Pacific into the western Pacific — was renamed Typhoon Keoni — and meandered for 2 weeks over subtropical waters north of Wake Island. From mid August into the first week of September, the monsoon trough of the western North Pacific became very active as it spawned seven tropical cyclones—Tasha, Vernon, Winona, Yancy, Zola, Abe and Becky. Vernon, Yancy and Zola hit Japan. From the last week of July through the first week of September seven of the period's twelve tropical cyclones made landfall over Japan.

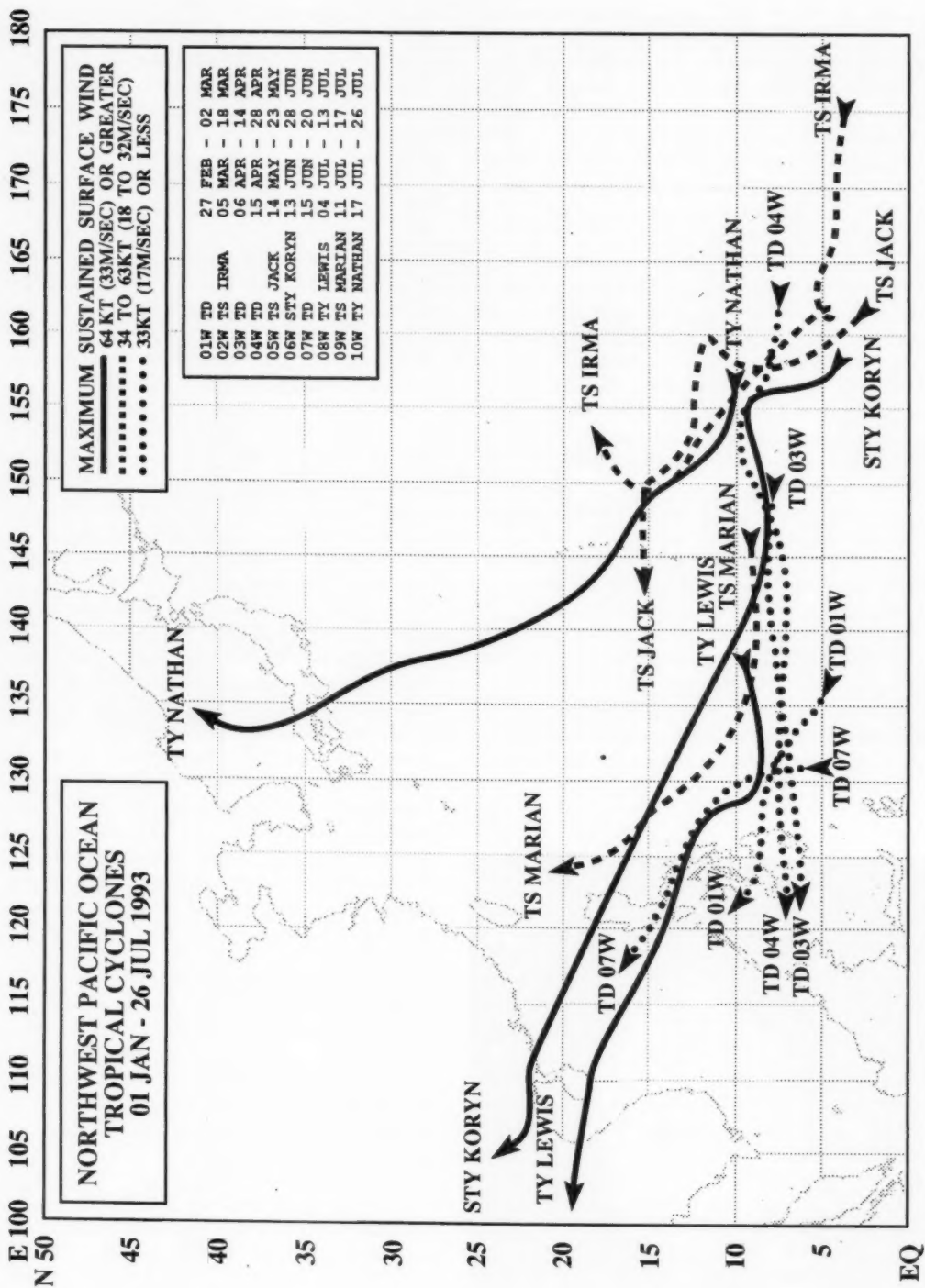
Five of seven tropical cyclones that came to life from late September to mid October — Cecil, Ed, Flo, Gene and Hattie — recurved into the mid-latitudes of the North Pacific well offshore of Japan. Hattie formed as a very large monsoon depression and recurved into mid-latitudes in late October. All subsequent tropical cyclones formed at low latitudes (near or south of 10°N) and traveled on westward tracks which kept them in the tropics. Six of the final eight tropical cyclones of 1993, beginning with Ira and ending with Nell, made landfall in the Philippine Islands.



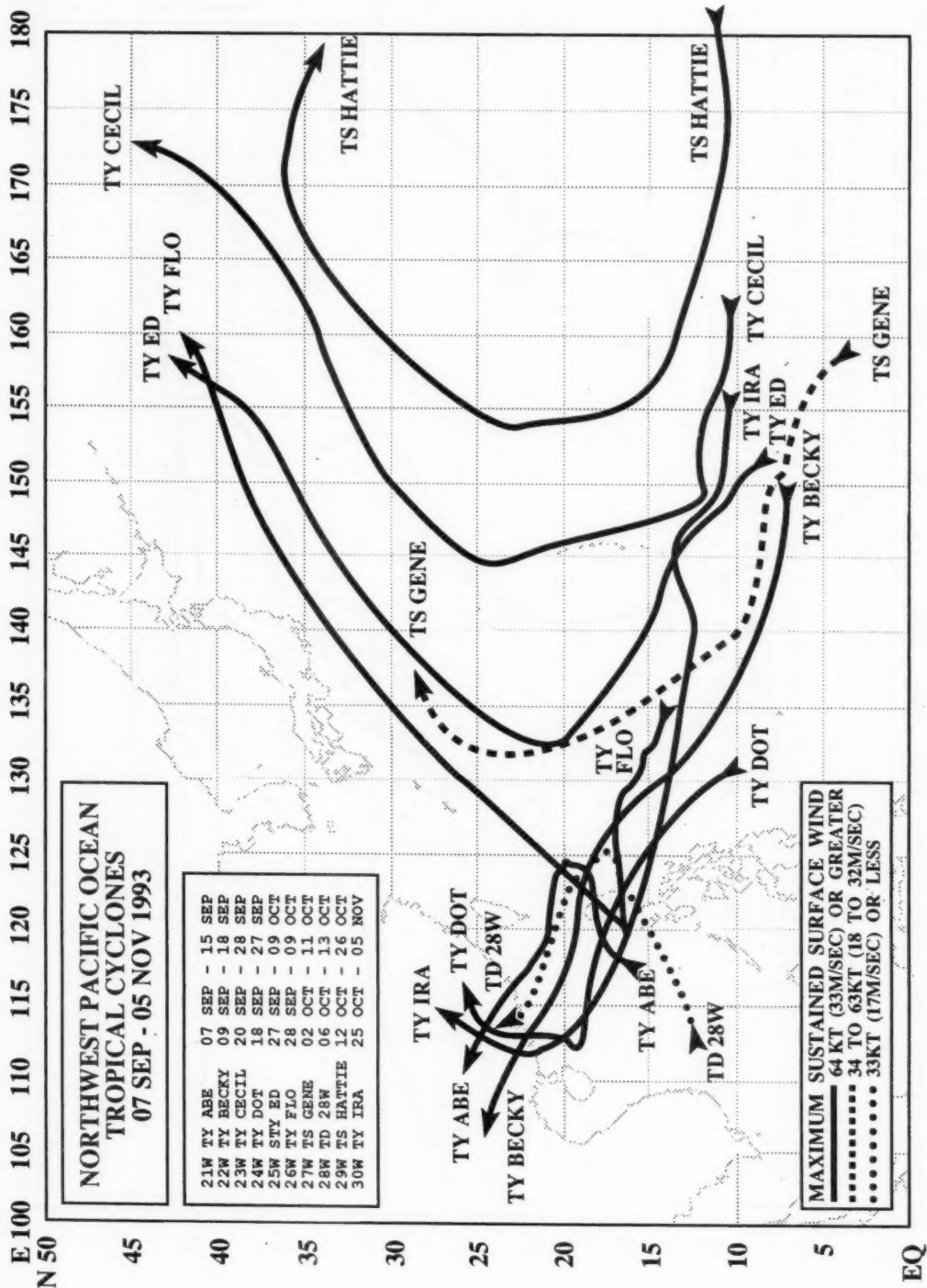
*Lola sporting a 20-mile diameter eye approaches southern Luzon on the 5th of December at about 1230 (visual GMS imagery).*

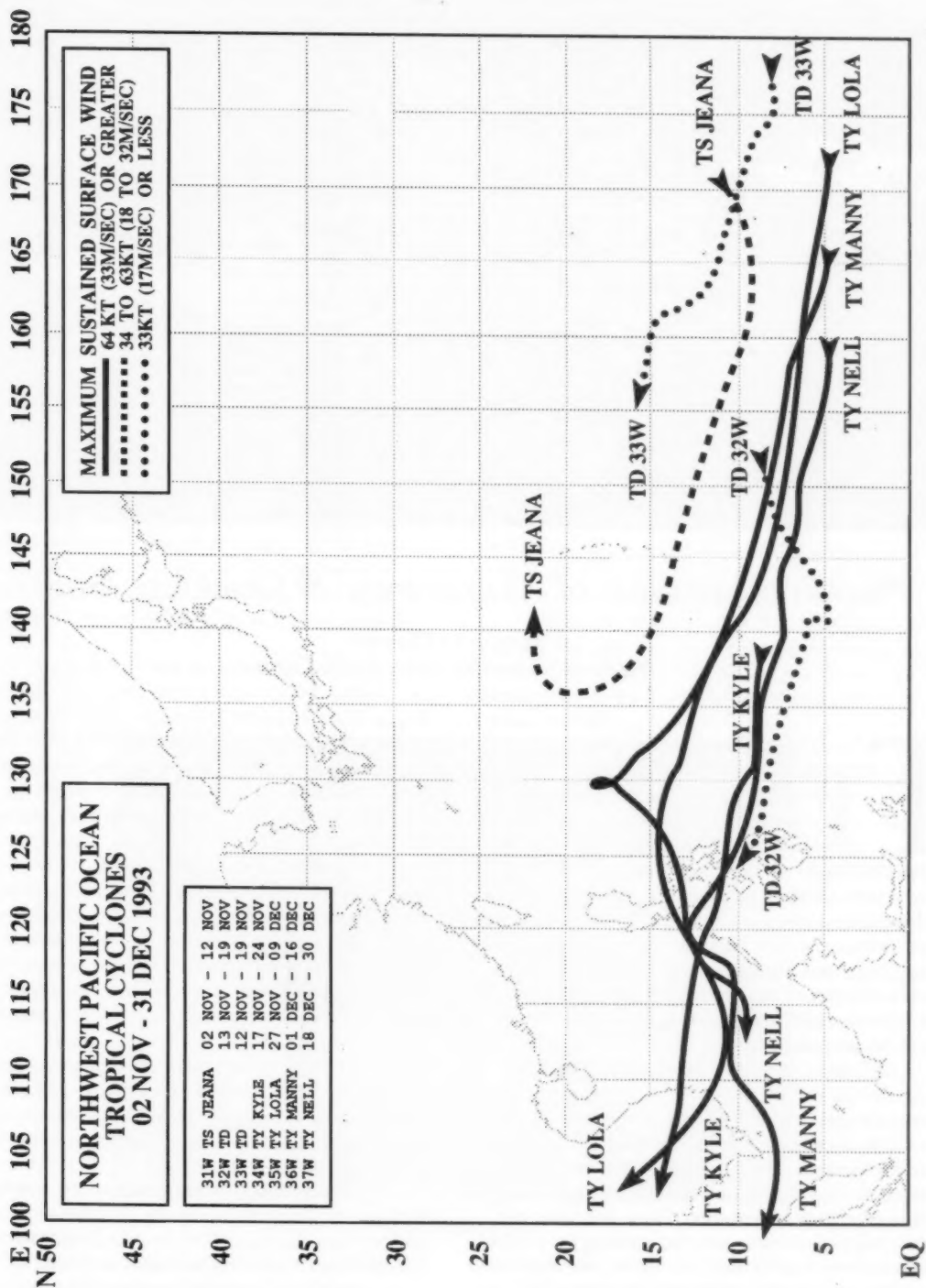
**I**n early November, three tropical cyclones — Jeana, Tropical Depression 32W, and Tropical Depression 33W developed, but failed to mature. Jeana reached 50 knots for only a brief time after recurvature. Jeana was one of a small subset of storms that reached peak intensity after recurvature. Tropical Depression 32W and Tropical Depression 33W both had long histories as disturbances. All subsequent tropical cyclones — Kyle, Lola, Manny and Nell — became typhoons. The last tropical cyclone of November, Kyle developed just to the northeast of Tropical Depression 32W. Both systems moved into the southern Philippine Islands in tandem. Tropical Depression 32W dissipated there. Kyle crossed the Philippine Islands into the South China Sea, moved toward Vietnam, and rapidly intensified.

In December an active near-equatorial trough produced a series of three late-season typhoons—Lola, Manny and Nell. After developing in the western Marshall Islands, Lola slowly intensified and, more than a week later, slammed into the heavily populated Bicol region of southern Luzon. Upon leaving the Philippine Islands, Lola headed toward the southwest, rapidly reintensified — a rare event in the South China Sea — and crashed into southern Vietnam. Three days after Lola developed, Manny began to form in the eastern Caroline Islands along the axis of the near-equatorial trough. Like Lola, Manny raced across the Micronesian Islands at 20 knots and slowly intensified. Unlike Lola, Manny slowed to the east of Luzon, and appeared to be very close to recurving; instead it executed an anticyclonic loop, then moved southwestward and rapidly intensified enroute to the Philippine Islands. Manny weakened to a tropical storm in the South China Sea, moved to the southern Gulf of Thailand, and dissipated over the Malay Peninsula. A few days later, Nell began to develop in the eastern Caroline Islands, about 300 miles west of where Manny had developed. Nell crossed the Philippine Sea at an average speed of 15 knots, slowly intensifying. Fortunately, Nell was a very small typhoon when it crashed into northern Mindanao, turned to the northwest, and crossed the Visayan Islands of Bohol, Cebu, Iloilo, and Panay. After crossing the Philippines, Nell ran into strong upper-level shear, turned toward the southwest, and dissipated in the southeastern South China Sea. The long westward tracks of the late-season tropical cyclones were associated with an anchored long wave trough over western and central China and a high zonal index of the mid-latitude westerlies. The western North Pacific basin continued to be active right up to the end of the year; on December 30, 1993, Nell dissipated in the South China Sea.











## Maritime Institute of Technology & Graduate Studies

*Nancy O'Donnell  
National Oceanographic Data Center*

**T**he distance between the rolling bridge of a supertanker plunging through 4-meter waves in the open ocean and the carpeted, quiet and very level classrooms at the Maritime Institute of Technology & Graduate Studies (MITAGS) may seem enormous. But discover the institute's mission—to provide continuing education for professional mariners—and the distance disappears. This connection between the campus and ocean-going vessels is seen most clearly in the Heavy Weather Avoidance course which today receives assistance from the National Oceanographic and Atmospheric Administration.

MITAGS, in Linthicum Heights, Maryland, was opened in 1972 as a training facility for the International Organization of Masters, Mates and Pilots, AFL-CIO. Its members are United States Coast Guard licensed merchant mariners who have the responsibility for the safe navigation and operation of vessels under their commands. Since that time, the institute has expanded to provide training for professional mariners from around the world, and the campus has grown to include eight simulators and a 225-room residence center.

At MITAGS, mariners enroll in a variety of

courses: Ship Handling, Radar Plotting Aids, Bridge Resource Management, Electronic and Integrated Navigation, Shipboard Medical Care, Fire Fighting, Hazardous Materials, Computer Applications, and Steam and Diesel Control Systems.

Combining the rigor of a university campus and the comfort of a modest resort, MITAGS provides a valuable service to tough customers. Since many shipping companies require mariners to attend courses in addition to the regulatory requirements set by the U.S. Coast Guard, as a condition of employment, many of the students give up valuable vacation time to complete the training.

These seasoned mariners demand training that is meaningful and tailored to "real-life" job requirements. The 5-day Heavy Weather Avoidance course taught by Glen Paine, a former mariner, attempts to meet their needs.

"Meteorology is what you expect, weather is what you get," says Paine on the first day of the class. And the class laughs. When he asks how many use 500-millibar charts, not one hand is raised.

Paine tries to teach mariners how they can use available vessel routing tools to minimize the impact of adverse weather on shipboard operations. Within the

course, students can take full advantage of the latest techniques and tools for weather routing—weather routing services, high seas radiofacsimile products, computer programs, as well as cumulative past experiences. The course especially emphasizes the use of 500-millibar charts for forecasting the movement of major storms. To help Paine with this section of the course, he is joined by meteorology professionals from such organizations as the National Weather Service.

Observing a class filled with such men is to get an education about a career rarely on the front page of newspapers. Independent, resourceful, some with advanced degrees, these men are used to going it alone with minimal shoreside support. Suggestions on how they should operate their vessels meet with a healthy skepticism since they know they will be the ones who bear the ultimate responsibility for the success or failure of the recommendations.

**E**xecutive Director of MITAGS, Captain Charles Pillsbury describes this independence: "Merchant seaman are used to living by themselves. They're used to being told 'This is what we want you to do' and they go out and get it done. They don't like people intruding. They'll say 'Tell me where you want the ship in 10 days, now go away.'"

Captain Bob Allen is one of the mariners with the "show me" attitude in the March 1994 course. "It's very easy to be seduced by the [computer routing] software," says Allen. "It's like a video game. All of this stuff has to be carefully evaluated."

Allen has a B.S. in Marine Transportation, a M.A. in English Literature and a Ph.D. in psychology. In his longest stint away from the ocean, he worked as staff psychologist at Halifax City Mental Facility in Canada. As the course nears the end, Allen's view changes and he says, "I will definitely look at [500 millibar charts] as a result of the class."

Kings Point graduate Captain John Bergin has sailed continuously since graduating in 1964. He

joined Sea-Land in 1969 and has been a master for 25 years, mostly in the Pacific.

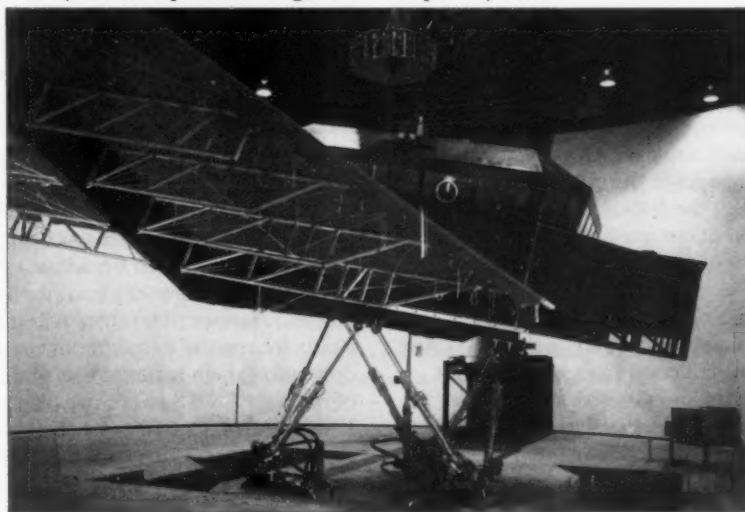
As for the 500-millibar chart, Bergin says, "I still don't think it will change my method of operations. I'll see if it can ... I'll reserve judgment." And as for a routing service, "I don't find it to be very accurate. Within the next 2 days, it's pure guess work. I can do better. I'm not saying it's useless. I just don't [use it to] plan my initial route."

Captain George Pedersen who says he came up "the foc'sle," started as a deckhand in Denmark in 1948. He's been licensed for 32 years, and today sails Alaskan waters.

Pedersen has much to say about "bad faxes," the ones that he receives that have little to do with the actual observations his vessel has sent in." By the end of the week he too sees the importance of the 500-millibar chart: "Things change. I don't think you ever get enough education."

Paine recognizes that careful instruction on how to use the 500-millibar charts will usually dispel any doubts. His good-natured responses and the presence of one of the meteorological "experts," Lee Chesneau of the NWS Marine Forecast Branch, helps to convince even the most skeptical.

Paine moves through a review of global and local weather patterns, wave formations, and boundary effects. Later in the week, he covers extreme weather phenomena—extratropical storms, explosive lows, tropical cyclones.

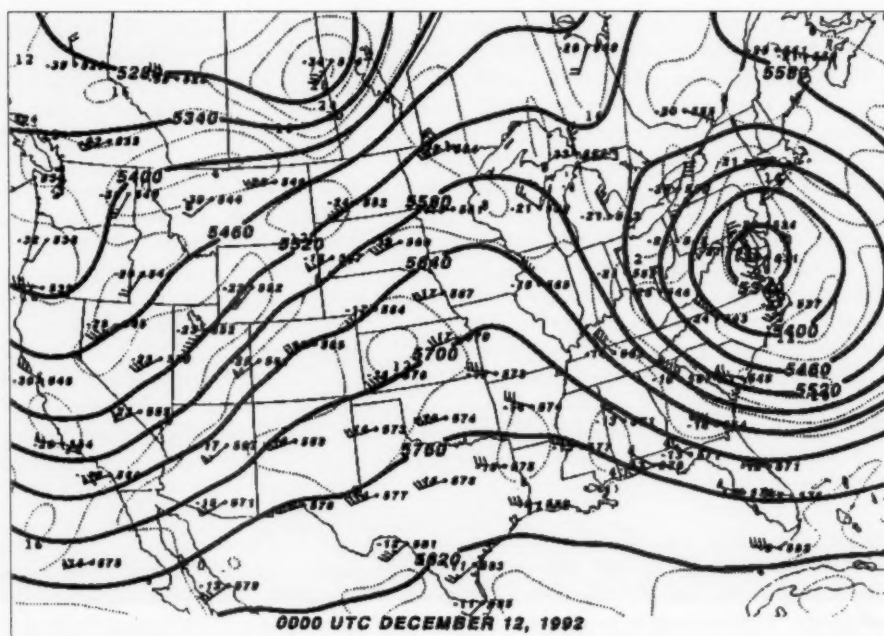


*Ship Simulator*

**T**he class focuses on practical application—the tools and techniques available to mariners in routing vessels away from heavy weather. In this section of the course, the mariners are shown how the 500-millibar chart can be used successfully for long range forecasting.

Paine and Chesneau both emphasize that surface weather conditions are heavily influenced by the weather in the upper atmosphere and to be conversant with the 500-millibar charts is the best strategy.

A 500-millibar chart from the Great Northeast of December 1992 at 0000 UTC on the 12th. The closed Low had moved little and was centered near the Chesapeake Bay, directly above the primary surface cyclone. To a forecaster, the vertical stacking of the surface and upper-level centers along with rising pressures at the surface low pressure center were indications that the cyclone had occluded and ceased to intensify further.



"Understanding air flow at the 500-millibar level is the key to increasing the accuracy of forecasted weather," says Paine. "By studying both surface and upper air conditions, a mariner increases his or her ability to assess weather conditions. With 500-millibar charts, mariners can determine general storm tracks out to 10 days."

Briefly, 500-millibar charts depict the heights above mean sea level where pressure equals 500 millibars. The solid lines or height contours on the chart will connect points of equal elevation and are similar to contour height lines displayed on surface topographical charts. Changes in the gradient or slope of the height contours, at the 500-millibar level, gives clues to the direction of the movement of the surface lows.

Lee Chesneau's devotion to the course (he spends considerable off duty time in the classroom) has precipitated changes back in his office. As Captain Pillsbury says, "Lee has taken the course to higher levels. Part of it is the fact that his name is on the chart. You're going to get a shot at the guy who's making the forecast."

Listening to the comments of the mariners led Chesneau, who received assistance from Paul Vukits and Joe Sienkiewicz of the National Weather Service, to make improvements in the entire Radiofacsimile program for the North Pacific and North Atlantic Oceans. An article in a recent MITAG publication describes the outcome of Chesneau's hard work: "On

January 31, 1994, the Marine Forecast Branch implemented major improvements to the number and quality of weather charts broadcasted to the mariner over high seas radio fax. Most of the new and upgraded products are a direct result of the suggestions and comments provided by the Masters and Mates attending the Heavy Weather Avoidance Course."

The improvements include the expansion of the Pacific program from 14 to 34 charts, and from 8 to 27 in the Atlantic as well as expanded surface analysis coverage to the North Pacific and North Atlantic Oceans using a two-part mercator projection chart (mariners no longer have to "fly blind" when approaching the area where NWS charts end and the foreign weather service charts begin).

The enhanced broadcast schedule now delivers weather charts to the mariner in a more timely and efficient manner. The change in format of most charts from polar stereographic to a mercator projection makes them easier to use, and increases the area of coverage. NWS has future plans to add 6- to 10-day storm track forecast charts and to annotate satellite pictures with significant features such as fronts, the jet stream and cyclogenesis.

In its third decade MITAGS continues to improve training that will assist the men and women who ply the seven seas to return safely to port.

*Subsequent issues of the Mariners Weather Log will feature the 500-millibar chart and its practical application to heavy weather avoidance.*

## Academy Profile



**G**len Paine wants his students to feel as strongly about his Heavy Weather Avoidance course as he does. "You can't separate shiphandling and weather; it's integrated," says Paine. "A mariner has his ship, the sea, and the weather to understand. The sea is the primary danger, and the impact of the seas tends to cause most of the damage."

Graduating from Kings Point Merchant Marine Academy in 1978 with a B.S. in Nautical Science, Paine acquired a Coast Guard License and a Chief Mate's License along the way and sailed on ocean going vessels until 1988 when he joined the staff at MITAGS. Over this time as many mariners do, he continued his education through self-study, especially meteorology.

Paine uses his marine background to great advantage at MITAGS. He describes the school as "a great equalizer" with practical hands on training. "We have a University broad-based view of the world, but we teach materials that have a direct impact on the [marine] profession. We're constantly evaluating, looking at feedback forms from the students, finding out what they need. It's a mariner driven course now."

"The class has changed tremendously over time," adds Paine. "Its first focus was oceanography and the theory of wave development when the mariners wanted vessel routing communications. They wanted information that would help them maximize the value of private routing services."

Paine also feels that graduates of the Heavy Weather Avoidance course will be able to intelligently engage these services when evaluating conflicting opinions and that mariners will get more out of computer routing by not blindly accepting it. "The mariner can ask the services 'Why are you sending me this? And the routers respects this. It keeps them on their toes.'" The addition of Lee Chesneau and other Marine meteorologists from the Marine Forecast Branch as a liaison between mariners and the Marine Forecast branch of the NWS has encouraged Paine.

"There's very little written on how to use 500-millibar charts. Some in the class have never used one because they felt they were geared to aviation. But it's within the mariners range to reach it once they understand that the 500-millibar charts allow long range planning. You can make better decisions in positioning your ship to take advantage of optimizing adverse weather conditions."

Paine feels that increasingly ships are just one part of the sophisticated global transportation network. Delays or damages due to weather will disrupt the process and increase costs. It has become essential Paine says for mariners to use all the tools available.

His sympathy is always with the mariner who he says must operate his vessel in an unforgiving environment that requires an optimum balance of time, cost and safety factors. Paine hopes the Heavy Weather Course will make a mariner's job more manageable.



## Beacons of the Delaware Gateway

*Elinor De Wire  
Gales Ferry, Connecticut*

**I**n 1623, Cornelius Jacobus Mey of Holland's West India Company sailed into the Delaware Bay. He passed between a pristine point of sand and sea oats on the southernmost tip of New Jersey and called this Cape Mey. The pine forested beach on the Delaware side, he dubbed Cape Cornelius. The tawny sands farther south along the Delaware shore he named for a compatriot in Amsterdam—Thymen Jacobsen Hindlopen.

Over the centuries, the capes' names and profiles have been altered: an early mapmaker dropped Cornelius in favor of Hindlopen, which, along with Mey, became Henlopen and May. Erosion has redrawn the shoreline, particularly on the Delaware side where a mile-long finger of sand called Point of Capes has been deposited. The character of the capes has changed too, from sleepy strands of spindrifted dunes to bustling resort towns with hotels, shops, restaurants, and the busy Cape May-Lewes Ferry terminals.

Mey had neither the benefit of a local pilot's keen navigational skills or a beacon to guide his way when he entered the bay nearly four centuries ago. Were he to venture into the estuary today, he would find himself dodging tugs and barges, mammoth tankers, 100-car ferries, and a regatta of pleasure boats. Lighthouses now



blink a greeting from both the northern and southern hinges of the gateway, and more lights beckon inside this vital artery to the ports of Wilmington and Philadelphia. In the last two centuries, some 30 lighthouses have been built and rebuilt on the Delaware Bay.

The first sentinel to stand over the entrance to the bay was the Cape Henlopen Light, built in 1767 on the Delaware side. Wrecking had been a profitable business

along this shore prior to the building of Cape Henlopen Light. No doubt the lightkeeper was welcomed with ambivalence, for his work was a boon for mariners but a bane for the wreckers. A few historians claim mooncussing was practiced here on black nights, using Judas Lanterns—oil lamps suspended on poles and rocked gently to and fro in imitation of a ship safely at anchor. The idea was to lure vessels onto the shoals, then board them and claim rights of salvage.

*In 1983 the Mid-Atlantic Center (MAC) for the Arts expressed interest in opening Cape May Lighthouse for educational purposes. A few years later, a grant from the New Jersey Historic Trust allowed MAC to restore the lighthouse and invite in the public. The tower now belongs to the State of New Jersey and is a popular landmark with Cape May's summer vacationers and traveler's on their way to the ferry terminal. The sketch was done by Paul Bradley Jr. and is reproduced with his kind permission.*



The original Cape Henlopen Light burned down during the Revolution and was rebuilt in 1784, octagonal in shape and closely resembling its sister-sentinel 150 miles to the north at Sandy Hook, New Jersey. Throughout its career, the lighthouse was plagued by erosion, but it remained in service until 1925. When the foundation became undermined, the lens was removed and the lightkeeper was sent to a new assignment. By then, two more sentinels had been built on a breakwater off Lewes.

A third beacon — the Harbor of Refuge Light — flashed on in 1901 on the outer stone breakwater, but only 7 years later it was leveled by a storm. Its successor also toppled when an extratropical storm crashed into Delaware in 1921. The current Harbor of Refuge Light, a cast-iron tower on a concrete caisson, has stood firm since 1926. But in that same year the abandoned Cape Henlopen Lighthouse collapsed in an April storm. The site is now under the ocean, but beachcombers occasionally find small chunks of brick at the tideline, smoothed by the sea and hurled ashore—battered mementos of Delaware's first lighthouse.

On the north side of the bay entrance is Cape May Point Lighthouse, tall and distinctive with its red lantern and beige walls. The first tower here was built in 1823, but local residents may have operated some sort of beacon prior to this time, as Cape May was home to pilots, shipbuilders, and whalers in the 1600s and was an important colonial seaport for Philadelphia commerce. The original light was brick, 21 meters high, and illuminated by 15 lamps with reflectors.

It was abandoned in 1847 due to the encroaching shoreline. The site of this tower is now about 91 meters offshore, and like old Cape Henlopen Light, shards of its masonry occasionally wash in with the tide.

A second brick tower at Cape May was much like the first — 24 meters tall and brick masonry. Only 4 years after it was lit, the newly-formed Lighthouse Board found it in poor condition, with an outdated illuminating apparatus and a less than model keeper. It was replaced in 1859 by the current 49-meter Cape May Point Light, which has operated continuously, except for a brief period of darkness during World War II because of the presence of enemy submarines off the New Jersey Coast.

During the years when families lived in the two keepers' houses, the station was an idyllic, shoreside assignment. The keepers' children passed the days swimming, building sandcastles, and beachcombing for shells and the water-smoothed shards of glass tourists called "Cape May Diamonds." Summers at the lighthouse were quaintly recalled in *Mary Elizabeth and the Cape May Point Lighthouse*—the memories of Mary Elizabeth Bennett Rott, niece of an assistant keeper in 1912. Her uncle Ed Hughes was paid \$480 a year and supplemented his income by "making bait boxes and selling them to tourists."

The last Cape May lightkeeper was Harry Palmer, a fastidious and well-liked man who raised prize-winning hydrangeas and in the 1920s won the Lighthouse Service's award for "best kept lawn." In 1933 after suffering a heart attack, Palmer was forced to hand over



*The original Cape Henlopen Lighthouse collapsed during a storm in April 1926. Above is a replica of Henlopen Lighthouse which can be found at Rehoboth, Delaware. Photo by author.*

lighthouse duties to his wife. Ada Palmer tended the beacon until it was automated in 1936.

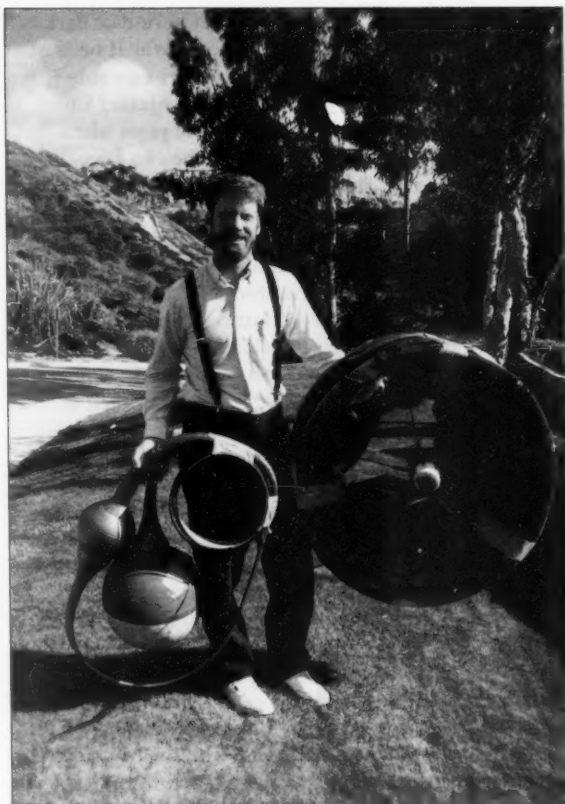
Thereafter, trips up the 199-step spiral stairway were made only during periodic maintenance checks. The Coast Guard assumed care of the lighthouse in 1939, and 7 years later the tower's antique, revolving, first-order Fresnel lens was removed and a less-attractive, modern beacon was installed. The classical French lens was given to the Cape May County Museum for display. The tower still sports a mesh bird screen, however, as it stands watch along the Great Atlantic Flyway and sometimes disorients the birds.

## Drifter News

*Laurence Sombardier  
Scripps Institution of Oceanography*

Since 1991, over 300 WOCE/TOGA Lagrangian Drifters have been deployed in the Pacific and Atlantic oceans by Voluntary Observing Ships (VOS). This number is expected to increase dramatically in the future especially with the full implementation of the Indian and Southern Oceans drifter arrays. It has become clear that the contribution of VOS to the Global Drifter Program is invaluable. And as more and more vessels are participating in the program, and more interest is being generated, a series of updates on drifter related matters is being added to the *Mariners Weather Log* quarterly features.

The Global Lagrangian Drifter was described in a previous article in the Summer 1993 issue of *Mariners Weather Log*. This oceanographic instrument is designed to record sea surface temperature while following water parcels vertically averaged over a drogue height of 6.5 meters and centered at 15 meters below the water surface. Data is relayed through the ARGOS satellite system. The drifter is specially packaged for



*This is the correct holding method for deployment of the standard Global Lagrangian Drifter.*



Picture of the first trial deployment of a drifter fitted with a SEACAT salinity sensor off of the *Pacific Islander*. A technician from ORSTOM, New Caledonia was specially sent onboard to test the deployment method. Drifter was lowered using the ropes seen on the deck on the left. The method has now been perfected so that deployment may be made by a single person. (Picture provided by Yves Montel.)

easy deployment off the stern of a vessel steaming anywhere between 2 and 30 knots. It weighs about 27 kilograms (60 pounds) and can be carried by a single person.

Systematic deployments from VOS started as early as 1988 in the Pacific Ocean and some vessels such as the *Polynesia* have been participating since that time. Others have been participating for only a year or two but have been doing so on a regular basis and have deployed up to 26 drifters in the past year and a half. The *Pacific Islander* has made an important contribution to the program by deploying drifters which demand a little bit more care than the standard instruments. The drifters are fitted with SEACAT salinity and temperature sensors which are a little more sensitive to shock. These

"salinity drifters" are lowered using ropes attached to the instrument drogue before being launched to sea.

The table shows a list of VOS vessels which have released drifters for the program from 1992 to mid September 1994. The help from these ships was greatly appreciated. The operational goal of the drifter program is to maintain an observing network of drifters in the world's oceans with roughly one drifter in every 5 degree square box. Many VOS ships are not called upon on a regular basis but rather when their path crosses a drifter-poor area of the ocean.

Starting in the fall of 1994, the Southern Ocean drifter array of 120 drifters is being implemented. The drifters used in this project are specially fitted with barometers to

measure air pressure. These instruments will continue to improve weather prediction because they will be contributing more measurements to a region of significant climatological importance. VOS ships will most certainly be called upon to participate in this exciting new project.

In next quarter's drifter update, drifter tracks from drifters launched by VOS ships will be presented. Should you have any suggestions on drifter topics you would like to see addressed in this column, you may send them to:

**Scripps Institution of Oceanography**  
Global Drifter Center  
University of California, San Diego  
Mail Code 0230  
La Jolla, CA 92093.

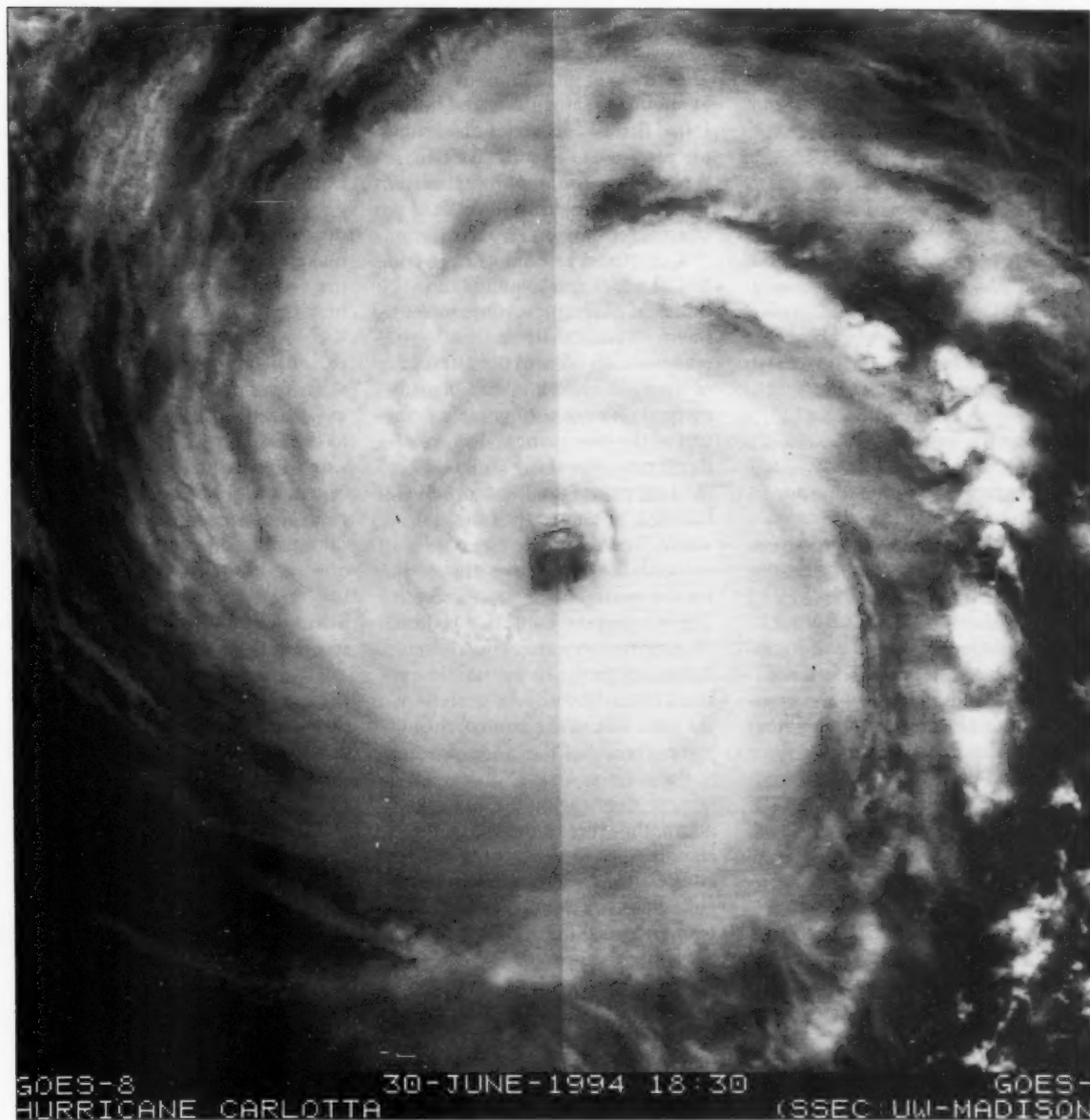


## Drifters

Vessel Name	Number of drifters deployed	Ocean	Year
Andino	2	Pacific	1993
Bibi	4	Atlantic	1992
Columbus Iselin	4	Pacific	1993
Columbus Wellington	3	Pacific	1993
Cumulus	4	Atlantic	1992
Infanta	2	Atlantic	1993
Joana Bonita	1	Pacific	1992
Joana Bonita	4	Pacific	1993
Jokulfell	4	Atlantic	1992
Jokulfell	4	Atlantic	1993
Longavi	1	Pacific	1993
Longavi	1	Pacific	1994
Mariner	4	Pacific	1993
Melbourne Star	2	Pacific	1994
Micronesian Independence	3	Pacific	1994
Mitla	4	Atlantic	1994
Monterrey	10	Pacific	1992
Navigator	3	Pacific	1992
Navigator	4	Pacific	1993
Nedlloyd Van Dieman	2	Indian	1994
Nedlloyd Van Neck	4	Indian	1994
Oaxaca	1	Pacific	1992
Oaxaca	5	Pacific	1993
Pac Prince	9	Atlantic	1992
Pacific Expolorer	2	Pacific	1994
Pacific Expolorer	8	Pacific	1993
Pacific Islander	12	Pacific	1993
Pacific Islander	14	Pacific	1994
Polynesia	3	Pacific	1993
President Monroe	8	Pacific	1992
Queensland Star	2	Pacific	1993
Queensland Star	5	Pacific	1992
Recife	1	Atlantic	1994
Recife	3	Atlantic	1993
Sea Wolf	2	Atlantic	1992
Sealand Achiever	2	Atlantic	1994
Sealand Achiever	7	Atlantic	1992
Sealand Achiever	7	Atlantic	1993
Sealand Consumer	7	Pacific	1992
Sealand Hawaii	3	Pacific	1994
Sealand Hawaii	6	Pacific	1992
Sealand Ile de France	4	Atlantic	1992
Sealand Innovator	11	Pacific	1992
Sealand Integrity	1	Atlantic	1994
Sealand Integrity	5	Atlantic	1992
Sealand Integrity	5	Atlantic	1993
Skogafoss	3	Atlantic	1992
Skogafoss	3	Atlantic	1994
St Blaize	4	Atlantic	1992
Strong Icelandier	7	Atlantic	1994
Tabasco	4	Pacific	1993



## GOES 8 vs GOES 7



*This split image of Hurricane Carlotta was taken by two satellites operated by NOAA's National Environmental Satellite, Data, and Information Service. The GOES-7 image is*

*on the right while the GOES-8 image is on the left. GOES-8 was launched on April 13, 1994 and is now operational.*



## Freak Wave on a Submarine

Edward J. Barr  
*Pocono Pines, Pennsylvania*

**W**e were a long way from the New London, Connecticut, submarine base that we'd left a few days earlier. A good guess put *Grouper*, the diesel electric sub aboard which I was serving about halfway between the Carolinas and our destination of Hamilton, Bermuda.

We'd been on the surface since shortly before midnight charging the batteries. It was morning, and having already tucked our binoculars under our coats in preparation for the dive, the other lookout and I rested easy. From high up above the bridge, the view of the horizon and the sky above indicated we were all alone.

Radar was quiet, and sonar had nothing to report. There was the usual last minute pre-dive communications between the navigator, who was down in the conning tower, and the OD (Officer of the Deck). The majority of us were looking forward to pulling into Bermuda again and to playing beer ball games at Horseshoe Bay. As with past trips south, training dives had long since become close to routine; but first, last and always, we were a U.S. Naval warship, and the skipper wanted us kept in shape and ready for action.

"Clear the bridge. Clear the bridge," the OD yelled, as he spun to get out of our way. He took one last look around then followed us below. Someone in control had sounded the diving alarm

at about the same time, and before it had finished its series of warning alarms, we had already passed through the conning tower and were dropping down into the control room.

Then, as now, once in control, the lookouts assumed the duties of planesmen. One took the stern planes—the large aft planes which control the attitude of the boat when it is running submerged. The other man takes control of the bow planes. Typical of the World War II fleet boat design, the bow planes are located well forward, just aft of the bow and above the waterline. When submerged, the bow planes are used for the most part to control depth. The actual hand controls for these planing surfaces are twin, 76-centimeter or so diameter, stainless steel, helm-like wheels located on the port side of the control room, just outboard of the ladder leading to the conning tower.

On hearing the diving alarm, the chief of the watch, standing just to the right of the controls for the bow planes at the ballast control panel, would reach over and push the control button to rig out the bow planes. This allowed the bow planesman (myself, in this particular instance) to simply slip onto the bench seat beside the stern planesman. The planesman would then take hold of the bow plane control wheel, give it a quick twist up and down to be sure the hydraulic system was operating, before centering the

planes and standing by for orders from the diving control officer, who stood immediately behind both planesmen.

"Take her to periscope depth" or, just as often, "Control, make your depth 18 meters," were the orders we were expecting to hear from the conning officer; and such orders shortly came down to us. His command was directed to the officer of the dive; and the diving officer repeated this same order to the bow planesman; and, word-for-word, this would be repeated right back to the diving control officer so that there was no doubt whatsoever to him or to anyone else in the control room that the bow planesman had not only heard the order but had also understood it.

Relatively experienced at the time, I knew how much of a dive angle on the bow planes was needed to pitch the bow down for the forward speed we were making. I knew how to start the descent, and how long to hold that "down angle" on those planes, and about when to level off or return the bow planes to a zero angle, so we would glide neatly into the desired depth (periscope depth in this case).

We were young and cocky then, and it was a matter of pride with those of us who were planesmen to see who could do this with a

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*This article first appeared in  
Ocean Navigator,  
September/October 1994*



## Editor's Choice

minimum of control movement. Since we'd spent so much time at sea and had practiced everything so many times while there, we were quite good at it.

As I said, we were young and cocky, and now that "class was assembled," we were about to learn a lesson; Neptune himself was at the podium.

Well before we approached 18 meters, as indicated by the large shallow-depth gauge just inches from my left wrist, I'd already put some rise on the bow planes to slow the descent, when out of the proverbial blue we heard the conning officer yell, in a rather annoyed tone at that, "Come on, people! Get me up! Get me up!" What was that guy yelling about, I wondered? He'd ordered 18 meters, and we were almost there.

As with everyone else in the control room, I didn't understand what he was talking about at first, but then I quickly spotted it. The needle on the shallow-depth gauge which the bow planesmen use to judge depth, had jerked; then, with an increasing pace, it began to arc downward. We were going down! None of us had much time to contemplate the downward swing of the needle on the gauge. As ordered, I put full rise on the bow planes, and, at the same time, we heard the conning officer tell the helmsman to ring up speed. Something unusual was going on, and although no one said anything, we all knew it.

For roughly the next 2 or 3 minutes, without a sound and in almost total disbelief, we watched the shallow-depth gauge go from about 15 meters to its maximum indication of 50 meters. It could tell us no more, as the needle had run into the stops. Worse yet, the needle on the deep-depth gauge (located right beside the shallow-depth gauge) had already begun to climb. While I concen-

trated on the bow planes, the diving officer reached over my shoulder and shut the inboard valve for the shallow-depth gauge. The needle on the deep-depth gauge settled at somewhere around 52 meters, and for what seemed like an eternity, it did nothing. One, two, three minutes went by, then it slowly began to recede, to come back down, indicating that we were on the way back up.

Again, the diving officer reached over my shoulder, this time to open the inboard valve of the shallow-depth gauge. In what was normally a busy and relatively noisy area, one could have heard the proverbial pin drop as we shifted our gaze from the deep-depth gauge back to the shallow-depth gauge. We all saw the needle on the shallow-depth gauge begin to rise, indicating that we were definitely on the way up. We came back up to 18 meters and just sat there. For the longest time no one in control said anything to anyone. By then some had already figured out what had happened. Only when I felt the diving officer's hand on my left shoulder as he quietly told us, "It wasn't your fault. You people did all right," did relief begin to set in.

Only one man saw what had happened that day, and his view couldn't have been all that great. When we were diving, the conning officer had started to raise the number one scope. By the time the bottom of the periscope had risen far enough out of its well in the conning tower so that the conning officer could get a look out of it, the boat was already underwater. By the time the man had put his eye to the eyepiece of the periscope, the top-most part of the number one periscope had already been engulfed by a wave, the leading edge of which had in all probability by then already passed over the sail and was proba-

bly well aft of the turtle back.

It was an almost clear day just prior to the dive. Surface visibility was as good as it could get. With our 8 x 50 binoculars, and with our stations up on the sail of the sub, there was little between the horizon and us that our lookouts ever missed. We may have been young, but we were darn good lookouts. If a wave were assembling, if it were rising and coming at us while we were on the surface, I never noticed it and neither did the OD, and the other lookout.

Where had it come from? What caused it? I don't recall ever having found out. However, based on both depth gauges in control, those routinely used to give indication of our true keel depth, we had a very good idea of the height of the wave: 30 meters, perhaps greater. The depth gauges operated by sensing water pressure. Since we had reached our depth of 18 meters, a pressure reading of 52 meters must have meant more than 30 meters of water passed over us.

Once we were back at ordered depth and sure that the crises had passed, relief began to set in and half-whispered comments were passed around, comments such as: "Do you believe that?" "Good thing no one was on the bridge." I recall looking over to the Chief, a man who had close to 30 years in the boats and who was close to retirement. He was well known for his wit and gift of gab, but he wasn't joking then. If Neptune had wanted to teach a few of us some respect for his power, he made a believer out of me that day.

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*Edward J. Barr is a retired submariner living in Pocono Pines, Pennsylvania.*

## Rescuer Dogs

*Elinor De Wire  
Gales Ferry, Connecticut*

**W**hen it comes to heroism, saving a life is surely at the top of the list, especially when it involves great risk. Rescuing someone from certain death is regarded as the supreme human deed, but it's also the supreme canine deed.

Among dog breeds, the Newfoundland is noted for its affinity for water and its rescuing ability. No doubt this is why Lewis and Clark chose a Newfoundland as the only four-footed member of their historic Corps of Discovery. During the journey to and from the Pacific Coast, Seaman proved his mettle on several occasions when he saved life and property from disaster on the Missouri and Columbia rivers. Meriwether Lewis named Seaman's Creek, near present-day Missoula, Montana, in honor of the big-hearted dog.

Newfoundlands developed as a breed in the Pyrenees Mountains of northern Spain and were taken by Basque fishermen to the rich fishing grounds off Newfound-

land, Canada. The dogs' thick coats, webbed feet, and great strength made them excellent for towing lines and maneuvering nets, and their loyalty to humans was quickly channeled into lifesaving.

They are still prized "sea dogs" today, evidenced by the "Newfoundland Water Rescue Test" held annually in a U.S. port city and sponsored by the Newfoundland Club of America. This



*Newfoundland*

is a chance for the gentle giants, who resemble black bears, to show off their skills—retrieving objects in the water, diving underwater, deliv-

ering life-rings, and rescuing people in distress.

Stories of Newfoundland bravery are numberless. One of the most dramatic tales concerns King, who lived aboard the British transport ship *Harpooner* just after the War of 1812. The *Harpooner* was returning to London from Quebec in November 1816 with 385 passengers, mostly soldiers. A few miles south of Newfoundland,

the ship encountered a violent storm and was pushed onto a rock ledge. A gash in the port side caused the the vessel to take on water and heel over. In the captain's quarters where King had been sleeping, candles fell to the floor and set the cabin on fire.

The dog bounded up on deck and caught the skipper by his coat, pulling him toward the cabin. The fire was put out, but another crisis quickly erupted when the *Harpooner* slid off

the ledge and began to sink. A few minutes later it struck again, snapped its masts, and lodged precariously in the rocks. The captain knew he would have to get everyone off the ship, for it was already



breaking to pieces in the pounding surf.

Two crewmen lowered a dory and paddled for shore to find help. Their plan went awry when the waves tossed the dory against a large, flat rock about 300 yards shoreward. The drenched crewmen scrambled on top of the rock and looked back at the stricken ship. They could not risk swimming to shore until the storm eased up and the tide ebbed.

The *Harpooner* creaked and moaned as the waves tore at it. The captain called King to his side, tied a rope to the dog's collar, and pointed to the men on the rock. King leaped into the surf and began swimming, cheered by anxious passengers and crew. As the dog neared the rock, debris created an obstacle course.

King paddled carefully among the flotsam. Just as he reached his destination, a large timber hit him, and he disappeared under the foam.

The crew and passengers, who had been cheering King's effort, shrieked in horror and disappointment, but minutes later the dog reappeared some distance from the rock and obviously in distress. The captain ordered him pulled back and discovered a piece of wood had caught under his collar, causing King to choke. As soon as the dog had recovered, a second attempt was made, this time with King hauling the rope in his mouth. After much cheering and canine effort, King reached the rock and delivered the rope, which the crewmen made fast to a makeshift tripod they had fashioned from debris.

A life-ring was rigged to the line and one-by-one the *Harpooner's* crew brought 177 survivors to the rock. A few drowned on the harrowing ride through the waves, and some panicked and jumped into the sea, hoping to swim ashore. Those who made it to the rock on the lifeline were rescued by fishermen from a village near the cliffs of St. Shotts. King was brought ashore too, and the story of his valiant swim with the lifeline was recounted. He had saved 155 lives.

A Newfoundland named Rubens is credited with a unique lifesaving skill—the ability to secure a rope. Rubens traveled with his master, a retired army officer named Robert Battersby, from New York City to California during the

Rubens' special skill involved swimming the river with a rope in his mouth, then securing the rope to a tree by wrapping it around the trunk several times and holding it in his teeth. Battersby then crossed, using the rope for stability, lest he and his horse be washed downstream.

On the dock at Acapulco, dog and master boarded the British steamer *Unicorn*, but the ship's captain refused to sail with a dog on board, saying it would bring bad luck. According to historian Edward Rowe Snow, Battersby composed a heartfelt note to the Captain and had Rubens personally deliver it. It read:

I am Rubens, Colonel Battersby's dog. I came all the way from New York across Mexico with my master. I have taken care of him for three years. I swam the torrent for him 117 times in one day! If you leave me behind, I don't know what will become of him, but am sure I will never see him again. Please, Captain, take me too. — Rubens.

The dog was allowed on board and traveled to San Francisco where he gained fame on the waterfront for his unusual talents with a rope and for saving several people from drowning in San Francisco Bay. In 1852, when Rubens was but five years old, he died. Robert Battersby was inconsolable. Unable to part with his four-footed friend, he asked a taxidermist to preserve Rubens in an alert pose. The dog stood mute by Battersby's front door for many years.



*Newfoundland Pup*

Gold Rush days via an overland route to Acapulco, Mexico, then by ship to San Francisco. In Mexico, the two gold seekers followed the Guarvucca River, which had to be crossed and re-crossed in the turbulent canyon where it cut through the Sierra Madre Mountains before pouring into the sea.



## Do Great Storms Change the Sea?

Laurence Lipsett  
Columbia University

**E**very Nor'easter that pummels the East Coast snatches a bit of the shoreline and takes it out to sea. Where does that sand go? Is it forever lost or does it make its way back to beaches? Do major storms disrupt fishing grounds, fill in boating channels and bury underwater cables?

A newly launched study, led by a scientist at Columbia University's Lamont-Doherty Earth Observatory, explored the effects of Nor'easters on coastal systems and established a "natural laboratory" in Block Island Sound.

In late July 1994, a team of four scientists mapped the ocean floor in the Sound. By comparing their findings with a sonar survey of the same area done for the Navy in 1991, they are seeing how the ocean floor was resculpted in intervening years by Nor'easters, including the major Nor'easter of December 1992 and the "storm of the century" in March of 1993.

The research should lead to greater understanding of coastal dynamics in Block Island Sound and in other East Coast continental shelf areas, such as Long Island's South Shore, Cape Cod and Cape Hatteras — all of which have seen

extensive destruction caused by Nor'easters in recent years.

"Nor'easters potentially cause more destruction over wider coastal areas than hurricanes, and they occur much more frequently," said Neal Driscoll, a geophysicist at Lamont-Doherty and the study's principal investigator. "They are called Nor'easters because their winds come from the northeast. These winds often reach 20 to 25 knots and last several days, driving monstrous waves directly toward the East Coast. These waves batter and inundate coastlines, causing extensive beach erosion."

For the study, funded by the Office of Naval Research, the scientists surveyed a 10-by 10-nautical-mile area ranging from the waters off Stonington, Connecticut and Montauk Point, Long Island, in the west to Weekapaug, Rhode Island, and Block Island in the east. They used two types of sonar to map detailed features of the seafloor and underlying structures. They towed an underwater camera in the 27- to 37-meter-deep waters to photograph seafloor features, and took samples of the sand and sediments on the bottom of Block Island Sound.

The 2-week survey was

done aboard the R/V *Cape Henlopen*, a 37-meter coastal zone research vessel operated by the University of Delaware.

The survey is expected to reveal a rich tapestry of features called sand waves and sand ribbons, both crafted by currents and tides in much the same way that winds sculpt undulating sand dunes in deserts. It should also reveal thin trenches cut by fishing trawlers dragging their nets along the sandy bottom, as well as more permanent features such as submerged valleys that might channel the flow of sand.

"In our initial survey, we want to see if some of these features were obliterated or redistributed by the effects of Nor'easters," said Dr. Driscoll. "If the bottom has changed dramatically since 1991, that has implications for beach erosion, fishing grounds and estuaries. We want to see if we can identify, year to year, whether the sand eroded from beaches by Nor'easters simply vacations at the bottom for a time, only to be used eventually to rebuild a beach next door in fair weather. Or is it lost to the system by being transported northeast toward Martha's Vineyard, or right off the continental



*The Great Nor'easter of December 1992 impacted the coast from North Carolina to New England. Driven and maintained by hurricane force wind gusts, very high tides and waves severely affected locations from New Jersey through Massachusetts. At Hull, Massachusetts its power was captured by photographer James Redman on December 13th.*



shelf and out to sea? Or does it temporarily fill in submarine canyons, clogging the quickest pathways out to sea?

The study is also looking at at extent that sand stirred up by Nor'easters might damage cables, pipelines, fishing traps, offshore wells and boating channels. Because submarines from the U.S. base in Groton, Connecticut, traverse the seaway, the Navy is interested in how storms might rearrange bottom sediments and change sonar patterns reflected off them.

"Once we establish a baseline picture of the Block Island Sound seafloor, we want to be able to rapidly deploy instruments immediately after major storms to see their effects," Dr. Driscoll said.

Nor'easters typically occur from October to April, when large temperature contrasts form between cold air masses over continents and warm air masses over relatively warmer ocean waters. Tropical air masses from Bermuda to

Cape Hatteras clash with the winter path of the Jet Stream, which brings a blast of polar air down and across the United States. The temperature gradient between the two air masses is resolved via a violent energy-releasing storm that tracks up the Eastern Seaboard.

The final ingredient for a Nor'easter is the simultaneous development of a strong, stable high pressure system that is common in winter months over eastern Canada, which prevents the developing storm system from moving swiftly northward and out to sea. Instead, the storm lingers on the coast, with its counterclockwise winds funneling moist air and heavy snow or rain from the northeast directly toward the East Coast. The gale-force winds drive towering waves over wide areas that batter the coast over several days and tidal cycles.

Adding to wave heights is a phenomenon known as storm surge—the combined effect of wind-driven water piling up along

the East Coast and the storm's low air pressure. Ocean waters rise as air pressures above them diminish. The combination of all these factors during Nor'easters commonly produces waves of 2 to 10 meters.

As an added scientific bonus, the research should also provide clues about ancient storm deposits on the seafloor, which will help scientists predict whether global warming might increase or decrease storm frequencies and intensities in the future. Dr. Driscoll has found rock layers that appear to have been sculpted by major storms in the Cretaceous Period 145 million to 65 million years ago, when dinosaurs roamed the planet. However, many scientists believe that the Cretaceous did not experience storms like those of today because its carbon dioxide-rich atmosphere produced uniformly warm conditions throughout the planet.



## Ship Synoptic Code Changes

*Martin S. Baron  
National Weather Service*

### **Dave Bakeman to Retire**

Dave Bakeman, PMO Seattle, has announced plans to retire January 3, 1995. Dave will have completed 38 years of government service, including 36 years with the National Weather Service. He has been PMO in Seattle for the past eight years. Dave worked at 12 other NWS stations, mostly in the western U.S. and Alaska. Three of his most interesting assignments were at NWS offices Marcus Island in the Pacific, at Point Barrow, Alaska, and at Lake Charles, Louisiana. Dave vividly remembers riding helicopters out of Lake Charles to visit weather stations on oil platforms in the Gulf of Mexico.

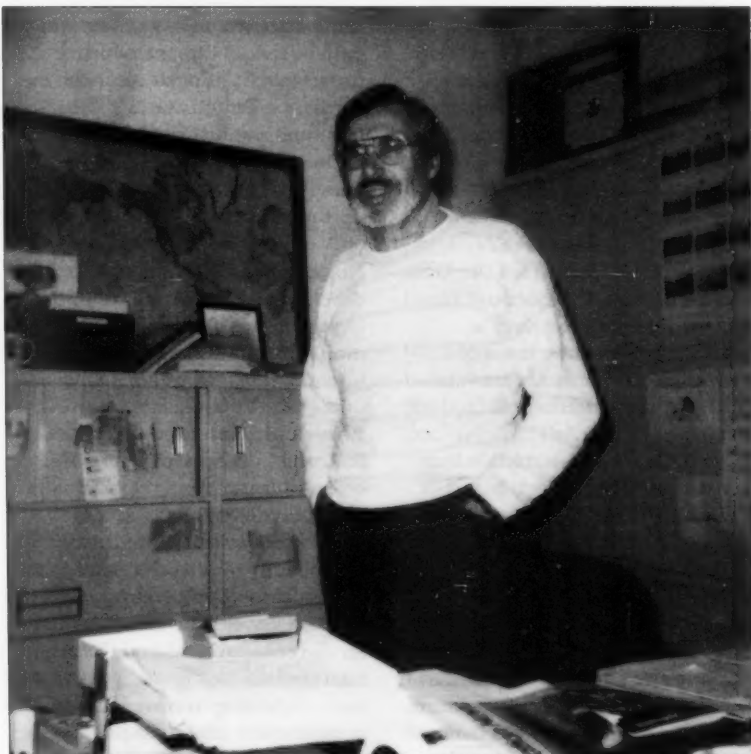
He will continue to reside in Lynnwood, Washington and, is looking forward to having more time to spend on photography, gardening and travel. He thanks the shipboard observers he's worked with for their time and effort as weather observers/reporters.

### **Marty Bonk Transfers**

Marty Bonk, formerly PMO Newark, NJ, is now the PMO in Norfolk, VA, filling the position vacated by Ray Brown's retirement. New PMOs are being selected for the vacancies in Newark and New

York, and these positions should be filled by the end of the year. The Newark and New York PMOs will be co-located at the Newark Airport, and will have the same phone number. They will work together to serve the New York/New Jersey Port Complex.

The Newark PMO will mainly service the ports of Newark and Elizabeth. The focus of the New York PMO will be the ports of Brooklyn (notably Red Hook), Staten Island, Bayonne, Jersey City and Manhattan.



*Dave Bakeman, PMO Seattle*



**A**s reported in the Summer 1994, *Mariners Weather Log* (MWL), the World Meteorological Organization has made several changes to the Ships Synoptic Code, which become effective November 2, 1994. This is not a major code revision like we had in 1982—the vast portion of the code remains unchanged. However, the changes were significant enough to require a re-printing of the observing forms (Ships Weather Observations form B-81, Weather Report For Immediate Transmission, Form B-80), and the Ships Code Card.

Port Meteorological Officers are passing out the new forms, dated June 94. They also have a one page summary of the Synoptic Code changes for you. If you have not already received these, please contact any United States PMO listed on the MWL inside back cover.

The changes are summarized below for reference. Please continue to report the weather using the forms you have (even after November 2) until you receive the new forms.

- (1) A New Group  $8S_w T_b T_b T_b$  for reporting wet bulb temperature (in degrees and tenths) will be located after the ice accretion group  $6I_s E_s E_s R_s$ . Wet-bulb temperature will be included with every weather message. (Wet-bulb temperature was formerly recorded (not transmitted) in a shaded column of form B-81 immediately following the dry-bulb temperature TTT. This shaded area will be removed from the new forms now being printed).

- (2) New indicator  $S_w$  — sign and type of wet bulb temperature.

- 0 positive or zero measured
- 1 negative measured
- 2 iced bulb measured
- 3-4 not used
- 5 positive or zero computed
- 6 negative computed
- 7 iced bulb computed

- (3) New indicator  $S_s$  — sign and type of sea surface temperature, replaces  $S_n$  before  $T_w T_w T_w$ .

- 0 positive or zero intake measurement
- 1 negative intake measurement
- 2 positive or zero bucket measurement
- 3 negative bucket measurement
- 4 positive or zero hull contact sensor
- 5 negative hull contact sensor
- 6 positive or zero neither intake, bucket or hull
- 7 negative neither intake, bucket, or hull

( $S_n$  remains the indicator for dry bulb temperature TTT and dew point temperature  $T_d T_d T_d$ ).

- (4) Indicator  $i_x$  — weather data indicator, to be coded as 1 or 3, rather than as 1 or 2.

- 1 present and past weather data included in report
- 3 omitted, no observation or data not available (rarely used — routinely code  $i_x$  as 1)

- (5) Groups  $7wwW_1W_2$  and  $8N_h C_L C_M C_H$  should be considered mandatory groups. Code as 7///// 8///// when weather or clouds not observed or not determined, 70000 80000 for clear sky, no clouds, no significant weather.

Examples for coding group  $8S_w T_b T_b T_b$ :

1. Using a sling psychrometer, your wet bulb temperature is  $3.5^\circ\text{C}$ .  $S_w$  is coded as 0, and  $T_b T_b T_b$  is coded as 035. Report the group as 80035. (If your wet bulb temperature had been  $-3.5^\circ\text{C}$  as measured with a sling,  $S_w$  would be coded as 1, and the group reported as 81035).

2. Again using the sling psychrometer, your wet bulb temperature is  $10.8^\circ\text{C}$ .  $S_w$  is coded as 0, and  $T_b T_b T_b$  is coded as 108. Report the group as 80108.

(If your wet bulb temperature had been  $-10.8^\circ\text{C}$  as measured with a sling,  $S_w$  would be coded as 1, and the group reported as 81108.

### The Importance of Data Accuracy

Great care must be taken at all times to ensure the accuracy of your data. A barometer reading as little as 1 millibar off, or air/sea surface temperatures as little as  $0.5^\circ\text{C}$  off can create complications for the meteorologist evaluating conditions at your vessel. Make sure your equipment is properly calibrated. A PMO should calibrate your barometer and barograph once every 3 months and also check your psychrometer during every ship visit. Sea-water thermometers (whether hull-mounted or located in the condenser intake) should be calibrated annually, and checked every time your vessel is in the yard for service. If your vessel has an anemometer, it should be calibrated once every 6 months. Make sure the anemometer is located



ed where the ships superstructure will not interfere with the air motion. When recording dry and wet bulb temperatures, always take your psychrometer to the windward side of the ship. This allows contact with air fresh from the sea which has not passed over the deck prior to your measurement.

If estimating wind speed using the Sea-State Beaufort Scale, please keep these factors in mind:

- (1) Heavy rain and floating ice will damp down the sea-surface, and can result in an underestimate of wind speed.
- (2) There is a lag period between the wind speed increasing or decreasing and changes in the sea-disturbance. As wind increases, the speed may be higher than indicated by the seas. As wind decreases the speed may be lower than the seas indicate.
- (3) Wind blowing against a strong current or tide will cause a greater sea-disturbance than normal and may result in an overestimate of wind speed.
- (4) Wind blowing in the same direction as a strong current or tide will cause a smaller sea-disturbance than normal and could result in an underestimate of wind speed.
- (5) Swell may cause more white-caps to form, because sea-waves have a greater tendency to break when they "piggyback" on the crests of swell.

The presence of any of these factors may require an adjustment to your wind speed estimates. Keep a close, continuous watch on the sea at all times. This makes it much easier to observe and report accurate wind speed and direction.

### The Importance of Report Timeliness

Weather is in a constant state of change. This is why your observation must be transmitted without delay as soon as possible after you have observed the data. The meteorologist uses your report to analyze existing conditions at and near your vessel (so called real-time conditions). Make your observation as close to the reporting hour as you can. Any transmission problems or difficulties with radio stations should be reported to your PMO and written down in the appropriate space on the back of the B-81 Ships Weather Observations form.

Report arrival times tend to be later at night and for Southern Hemisphere reports. Please make every effort to improve the timeliness of these reports.

### The Importance of Receiving Data From All Areas

Reports are not available in equal numbers from all areas. There is a chronic shortage of data from coastal waters out 200 miles (for this reason, 3-hourly reports are requested from U.S. and Canadian waters out 200 miles from shore). There is also a widespread shortage of data from the Southern Hemisphere and from the Arctic Ocean. More data is also needed from the tropics and easterly trade wind belt (5-35°N), especially during the N. Hemisphere hurricane season (May-November). From the North Atlantic and North Pacific oceans, more data is needed at 0600 and 1200 UTC (these are late night and early morning times). Data is most readily available from

the main shipping routes in both hemispheres. If you are operating from a data-sparse area, please report weather regularly while underway. These reports are especially well appreciated.

### New Recruits July-September 1994

During the 3-month period ending September 30, 1994, PMOs recruited 41 vessels as weather observers/reporters in the National Weather Service (NWS) Voluntary Observing Ship (VOS) Program. Thank you for joining the program.

The worldwide weather reporting schedule for Voluntary Observing ships is four times daily - at 0000, 0600, 1200, and 1800 ZULU or UTC time. The United States and Canada also have an important 3-hourly weather reporting schedule from coastal waters out 200 miles from shore, and from anywhere on the Great Lakes. From these areas, please report weather at 0000, 0300, 0600, 0900, 1200, 1500, 1800, and 2100 ZULU or UTC, whenever possible.

To report weather, use (1) INMARSAT Standard A or Standard C (see the radio tips column) (2) U.S. Coast Guard Simplex Teletype Over Radio (SITOR), plain language (recite the coded message using radiotelephone), or high frequency Morse Code, (3) commercially operated shore radio stations (using SITOR or CW), as a backup.

**NATIONAL WEATHER SERVICE VOLUNTARY OBSERVING SHIP PROGRAM  
NEW RECRUITS FROM JULY 1, 1994 TO SEPTEMBER 30, 1994**

NAME OF SHIP	CALL	AGENT NAME	RECRUITING PMO
ADM. WM. M. CALLAGHAN	KGYE	KEYSTONE SHIPPING	NEWARK, NJ
ARIZONA	V2MF	RIISE SHIPPING INC	JACKSONVILLE, FL
ATLANTIC SUPERIOR	C6BT8	T. PARKER HOST	BALTIMORE, MD
BELGRANO	P3HR2	PMO	HOUSTON, TX
BLED	J8EK	SPLOSNA PLOVBA PIRAN	SEATTLE, WA
BLUE SAPPHIRE	ELNV9	REDERI AB SUNSHIP	MIAMI, FL
CARIBBEAN MERCY	3FFU4	MERCY SHIPS	MIAMI, FL
CHEVRON OREGON	WNHL	CHEVRON SHIPPING CO	SAN FRANCISCO, CA
COLUMBUS CANADA	ELQN2	COLUMBUS LINE	LOS ANGELES, CA
CORNELIA MAERSK	OXIF2	MAERSK LINE	NEWARK, NJ
DELMONTE PLANTER	ELIT7	DEL MONTE FRESH FRUIT INTL.	MIAMI, FL
DODGE ISLAND	WYQ7951	NATCO	MIAMI, FL
DOLE COSTA RICA	ICRD	DOLE FRESH FRUIT INTL., LTD.	MIAMI, FL
DOLE HONDURAS	ICWF	STAN. FRUIT & STEAMSHIP CO.	BALTIMORE, MD
E.W. MCKINLEY	3EVY	EASTWIND SHIP MGMNT	MIAMI, FL
EVER RENOWN	3FFR4	EVERGREEN MARINE CORP.	LOS ANGELES, C
FALSTRIA	C6BD8	STAR SHIPPING (U.S.W.C.) INC.	SEATTLE, WA
GEORGE SCHULTZ	ELPG9	J. E. ASPEN SHIPPING CO.	BALTIMORE, MD
GOLD RIVER	LAFO4	WILLARD IVER, INC.	NEWARK, NJ
GULF CURRENT	LMF9	SINGA SHIP MANAGEMENT	NEWARK, NJ
IBN AL-MOATAZ	HZLH	UNITED ARAB AGENCIES INC	BALTIMORE, MD
ISLA GRAN MALVINA	LQOK	DELEUSA	NEWARK, NJ
JOSEPH LYKES	3ELQ9	LYKES BROTHERS SHIPPING CO.	BALTIMORE, MD
MINERAL OSPREY	ELND2	ANGLO EASTERN SHIP MGMNT	MIAMI, FL
NACIONAL VITORIA	XCSG	OCEANS INTERNATIONAL	HOUSTON, TX
NORTHERN LION	A8IE	NORTH AMERICAN SHIP AGEN.	LOS ANGELES, CA
NOVA ZEELANDIA	C6LA7	NETWORK SHIPPING LTD	MIAMI, FL
OCEANUS OSAKA	3EQZ6	NYK LINE, NA INC.	NEWARK, NJ
ORIENTAL FERM	DZDB	DAKILA OCEAN NAV. CORP	MIAMI, FL
SAN ISIDRO	DIOR	IVARAN AGENCYS INC.	NORFOLK, VA
SEALAND GUATEMALA	OVJV2	BRANDTSHIOP USA, INC	MIAMI, FL
SEJORITA	LADN4	UGLAND MARITIME	MIAMI, FL
SERAFIN TOPIC	ELBZ2	NEW ENGLAND SHIPPING CO	BALTIMORE, MD
SONORA	XCTV	OCEANS INTERNATIONAL	HOUSTON, TX
TEAL ARROW	C6KB8	WESTFLEET MANAGEMENT	NEWARK, NJ
USCGC STEADFAST	NSTF	COMMANDING OFFICER	SEATTLE, WA
USNS COMFORT	NCOM	MILITARY SEALIFT COMMAND	BALTIMORE, MD
VISAYAS VICTORY	DZVP	STAR SHIPPING (NY) INC	BALTIMORE, MD
VOROSMARTY	HAAT	MASSAN SHIPPING	BALTIMORE, M
WESTERN LION	A8BN	NORTH AMERICAN SHIP AGEN	LOS ANGELES, CA
YUCATAN	XCUY	OCEANS INTERNATIONAL	HOUSTON, TX



## Fax Broadcast Changes

In an effort to try to improve service to the customers of their 1415 UTC and 2015 UTC facsimile broadcasts, Coast Guard CAMSPAC San Francisco/NMC has started using different transmit antennas that we hope will provide improved propagation to the region covered by the National Hurricane Center's 1200 UTC and 1800 UTC tropical analysis. These products are broadcast on 8682, 12730, 17151.2 and 22528.9 kHz at 1535 UTC and 2144 UTC. They provide tropical storm and hurricane tracking in the area from 150°W to 80°W between 20°S and 20°N. This change of antennas began on August 1, 1994 and only affects these two broadcasts.

This change is a result of greatly appreciated feedback from our customers. Due to directional antenna limitations, we are limited in our abilities to make significant changes. We are soliciting comments on the quality of broadcasts before and after the change. Please include your position and dates the broadcasts were received. In addition, include your receive antenna size, type and orientation (horizontal/vertical mount) and other information about your installation. We appreciate hearing from the mariner about the quality of this important product. Send your comments to:

**Commanding Officer (Ops)  
USCG CAMSPAC San Francisco  
P.O. Box 560  
Pt. Reyes Station, CA 94956**

## KFS Super Station Network

Ships at sea now have more choices than ever to send and receive their Telex and e-mail traffic. KFS World Communications commissioned VCT in Tors Cove, Newfoundland, the third station in the company's network of public coast stations. This network now covers both the East and West Coasts of the United States, the North Atlantic Ocean, the entire Pacific Ocean, the Panama Canal, the Caribbean Sea, the Gulf of Mexico and the midAtlantic Ocean.

The network was started 2 years ago when KFS World Communications installed remote con-

trol equipment and data lines between WNU in New Orleans and its centralized traffic facility in Half Moon Bay, California. This connection and now a similar one to Newfoundland, allows ships at sea to contact the most convenient station for messages, all of which are stored in a sophisticated computer system in California. Traffic lists sent by the three stations are identical and include every message on hand. Radio operators can determine if they have traffic waiting by listening to just one such broadcast.

ITU CH	Call	Location	Selcal	Shore Xmit	Ship Xmit
401	WNU	LOUISIANA	1109	4210.5	4172.5
403	KFS	CALIFORNIA	1094	4211.5	4173.5
416	VCT	NEWFOUNDLAND	1094	4217.5	4180.0
603	KFS	CALIFORNIA	1094	6315.5	6264.0
627	WNU	LOUISIANA	1109	6327.0	6281.0
632	VCT	NEWFOUNDLAND	1094	6329.5	6283.5
803	KFS	CALIFORNIA	1094	8417.5	8377.5
812	VCT	NEWFOUNDLAND	1094	8422.0	8382.0
819	WNU	LOUISIANA	1109	8425.5	8385.5
1203	KFS	CALIFORNIA	1094	12580.5	12478.0
1219	WNU	LOUISIANA	1109	12588.5	12486.0
1257	WNU	LOUISIANA	1109	12607.5	12505.0
1263	VCT	NEWFOUNDLAND	1094	12610.5	12508.0
1643	VCT	NEWFOUNDLAND	1094	16827.5	16704.5
1647	KFS	CALIFORNIA	1094	16829.5	16706.5
1657	WNU	LOUISIANA	1109	16384.5	16711.5
2203	KFS	CALIFORNIA	1094	22377.5	22285.5



## News from Hong Kong

The Hong Kong Coast Radio Station has changed its call sign from "VPS" to "VRX" as of August 2, 1994. Ships sending observations to them by Radiotelegraphy or Radiotelex should pay special atten-

tion to this.

Hong Kong has received from the World Meteorological Organization (WMO) a computer software package for compiling, encoding and transmitting ship weather reports through Inmarsat-C. This software was

developed by the Royal Netherlands Meteorological Institute (KNMI). To run the software, a DOS personal computer with at least 410 KB free working memory and an Inmarsat-C communication system for transmission of the observations are required.

### Operation Schedule The Hong Kong Station—Hong Kong Radio

#### (1) Radiotelegraphy

Band		Answers on		
(MHz)	Keeps watch on	Call Sign	Frequencies (kHz)	Hours of Operation
	500kHz	VRX	500/526.0	0000-2400
	512kHz <sup>(1)</sup>	VRX	526.0	0000-2400
4	Comm Ch. 3, 4 Grp 2 Ch. 5, 6	VRX8	4232.5	1000-2100
8	Comm Ch. 3, 4	VRX35	8539.0	0000-2400
	Grp2 Ch. 5, 6	VRX 26 <sup>(2)</sup>	8584.0	0000-1300
12	Comm Ch. 3, 4 Grp 2 Ch. 5, 6	VRX60	13020.4	0000-1500
16	Comm Ch. 3, 4 Grp 2, Ch. 5, 6	VRX80	17096.0	0000-1300 & 2100-2400
22	Comm Ch. 3, 4 Grp 2 Ch. 5	VRX99	22536.0	0300-1000

(1)—Hong Kong Station (VRX) keeps continuous watch, calls and answers calls on 500 kHz. When distress working on 500 kHz is in progress, watch will be kept on 512 kHz and answer made on 526.0 kHz.

(2) VRX36 (8584 kHz) is allocated exclusively for the reception of OBS messages from ships between 0000-01000 UTC and 0600-0700 UTC.

#### (ii) Radiotelex

The call-code number is 1.04631, and the answer-back code to ship is "4631 HKRDO VRXZ"

#### Channel Series

Number	Call Sign	VRX Transmits (kHz)	VRX Receives (kHz)	Hrs. of Operation UTC
0618	VRX23	6322.5	6271.5	1000-2300
0811	VRX33	8421.5	8381.5	0000-2400
0817	VRX34	8424.5	8381.5	2300-1000
1213	VRX63	12585.5	12483	0000-2400
1223	VRX64	12591	12488.5	2300-1400
1630	VRX83	16821	16698	0000-2400
1650	VRX84	16821	16708	2300-1400
2206	VRX93	22379	22287	2300-1000



## Painted Ships on Painted Oceans

*Teresa Fremaux  
The Mariners Museum  
Newport News, Virginia*

**A**ntonio Jacobsen (1850-1921) nearly always kept a sketchbook at hand as he traveled the New York harbor area, ready to sketch a vessel on commission or speculation. A native of Copenhagen, Jacobsen arrived in New York City

in 1873 determined to make a living as a painter of ships.

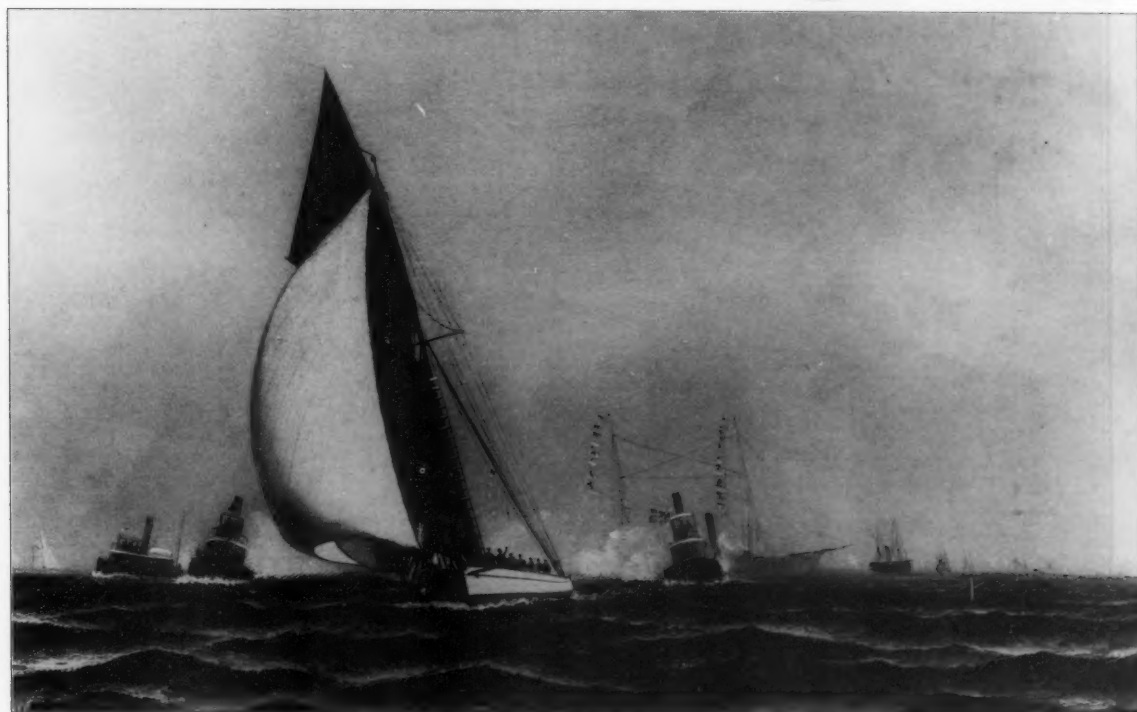
The talented 23-year-old found work painting decorations on safe fronts. Soon he was painting ship portraits for ship brokers and owners, shipping companies, captains and crew members. As his reputation grew, he gained con-

tracts to paint multiple portraits for White Star, Cunard, Holland-America, French and Clyde lines.

Jacobsen is considered perhaps the most prolific of all marine artists. During his career he documented thousands of sail and steam vessels that frequented New York harbor between 1873 and



46 Mariners Weather Log



Steaming through rough seas (left) is the *Chicago City*, an oil on canvas from 1894. Amid the flurry of flags waving and cannon saluting, the American cutter yacht *Volunteer* (above) crosses the

finish line in an 1887 America's Cup race. The centerfold depicts the *City of Berlin*, an oil on canvas from 1879. All photographs courtesy of The Mariners Museum, Newport News, Virginia.

1919. His sketchbooks reveal his elaborate method of using scale marks to depict the proportions of a ship dividing the sketch over several pages of his notebook. It has been estimated that Jacobsen may have painted as many as 6,000 ship portraits during his lifetime. Approximately 3,300 are known to exist today, with more coming to light each year.

Working largely before photography was widely used, Jacobsen portrayed many vessels that would have otherwise gone undocumented during the era of transition from sail to steam. His works include an amazing variety of vessels, including tugs, pilot schooners, steam and sail yachts, clipper ships, lightships, ferries and

naval vessels.

The exhibition at the Mariners Museum will highlight the diversity of Jacobsen's works including America's Cup races, New York Harbor scenes, and disasters at sea.

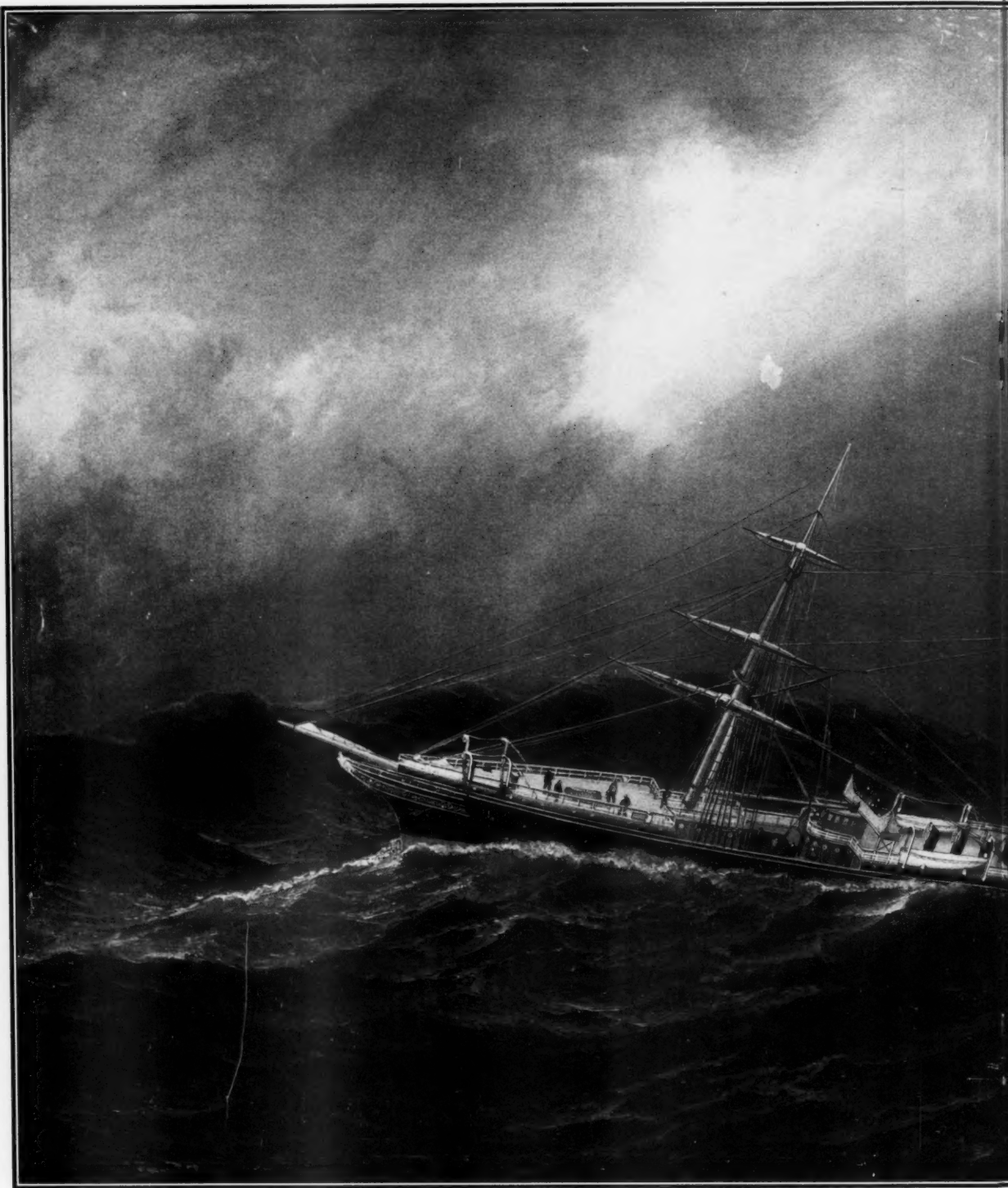
The exhibition will run through February 19, 1995 and is the first major Mariners Museum show to travel in more than 30 years. This marks the beginning of The Mariners' initiative to develop exhibitions that will be offered to other museums.

Antonio Jacobsen's *Painted Ships on Painted Oceans* is being presented in conjunction with the publication of a book of the same name, written by Curator Emeritus Harold S. Sniffen. The lushly illus-

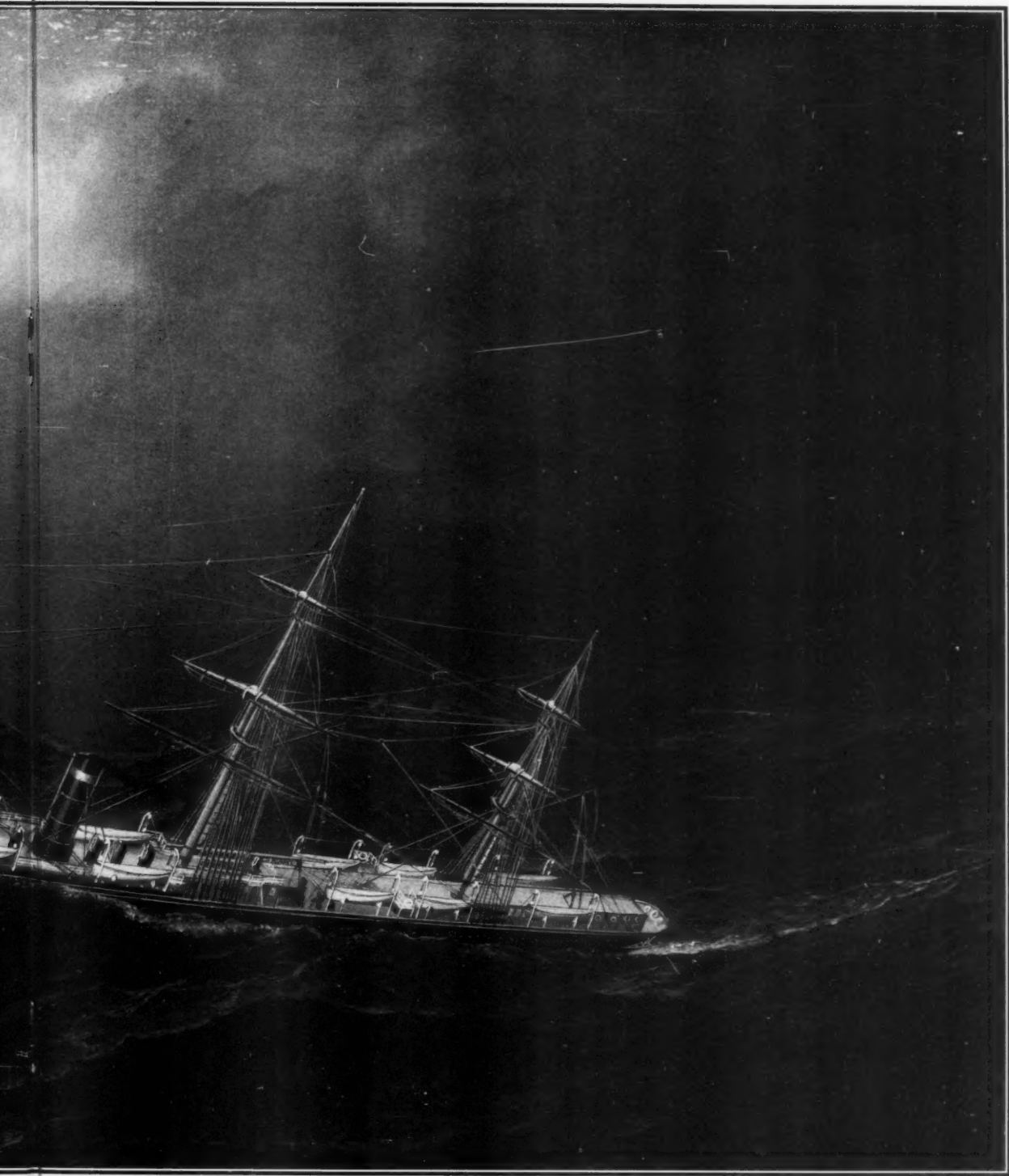
trated biography and examination of Jacobsen's work, which is the culmination of more than 21 years of research by Sniffen is available from the Mariners Museum. The cost is \$75 for the 180-page book which contains 100 illustrations. Single copies can be ordered from:

**The Mariners Museum Gift Gallery**  
100 Museum Drive  
Newport News, Virginia 23606

*The Mariners' Museum is an educational, nonprofit institution accredited by the American Association of Museums, which preserves and interprets maritime history through an international collection of ship models, figureheads, paintings and other maritime artifacts.*



City of



of Berlin



## A Titanic Myth Dispelled and A Plea for Lighthouse Memorabilia

### From the Titanic Historical Society

No doubt you'll get a number of letters regarding the Sarnoff-Marconi photo and caption on pages 2 and 3, but just in case you don't, I'll upgrade your data a bit on Mr. Sarnoff. It has always been a great *Titanic*-related myth that young Sarnoff was atop the Wanamaker's Building in New York, hearing the first distress call from the *Titanic* and having President Taft order all wireless sets to be silent so Sarnoff could relay lists of those who survived to the press. RCA never did anything to dispel this legend, it was good for publicity.

Actually, the Wanamaker store was closed that Sunday when the *Titanic* hit the iceberg and so Sarnoff was not at his station. When he arrived there Monday morning, the Taft order was already in effect and Sarnoff learned this from his fellow wirelessman stationed in Wanamaker's in Philadelphia. Sarnoff closed down his operation and went down

to Long Island to listen to the signals down there. He did take down the messages and relayed them on to the *New York American*.

This was all documented in the television show, *Empire of the Air: The Men Who Made Radio* by Tom Lewis in 1991, and the book is still available through the Society.

Ed Kamuda  
The Titanic Historical Society  
P.O. Box 51053  
Indian Orchard, Massachusetts  
01151-0053

*Thanks to Ed and the Titanic Historical Society for their input. The story about Sarnoff appears in quite a few publications and we are happy to print the real story.*

### From the Ohio Sea Grant

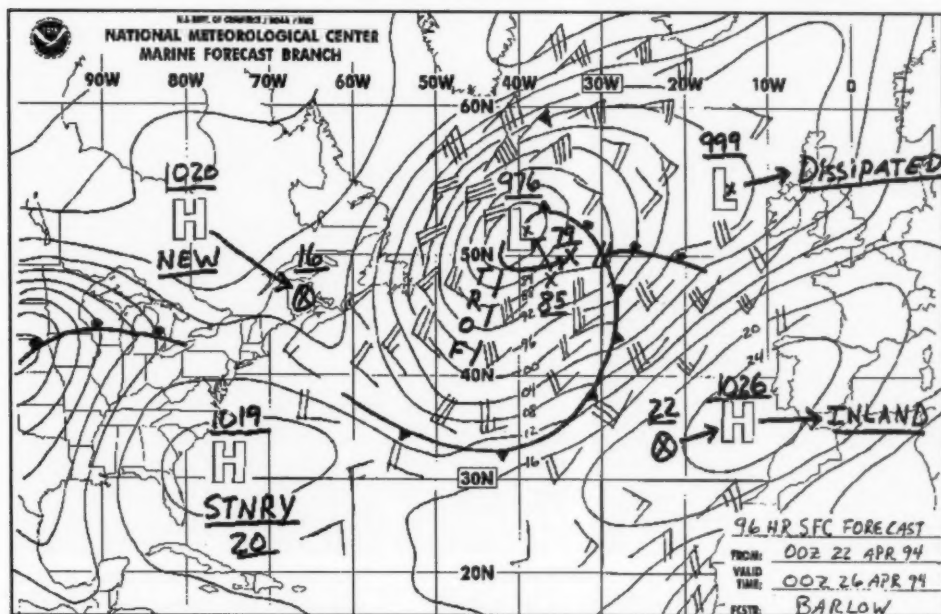
I'm cooperating with the county visitor bureaus along Ohio's Lake Erie shore and with the Ohio Lake Erie Commission to create a shoreline circle tour brochure.

We're working on two other projects your readers may be

able to help with. Both Stone Lab and the South Bass Island Lighthouse have been around for 100 years. We're looking for any historical facts, illustrations or photographs, especially from the time the Lab was created and the lighthouse was constructed to about 1960.

Stone Lab didn't move to its present location on Gibraltar Island until 1928. From 1895 to 1900 it was on the second floor of the fish hatchery building in Sandusky. From 1900 to 1908 it was in its own building near where Cedar Point Amusement Park is now and from 1908 to 1928 it was on the second floor of the fish hatchery building at Put-in-Bay. Thanks for your help.

Maran Brainard Hilgendorf  
Ohio Sea Grant College Program  
Franz Theodore Stone Laboratory  
Center for Lake Erie Area Research  
Research Center, Room 1541  
1314 Kinnear Road  
Columbus, Ohio  
43212-1194



The 96-hour surface forecast chart of the North Atlantic was issued at 00Z on the 22nd of April 1994 and was valid for 00Z on the 26th of April 1994. It was prepared by Barlow of the Marine Forecast Branch of the National Meteorological Center.

## The 96- and 120-Hour Surface Forecasts

Lee Chesneau  
National Weather Service

**T**hese forecast products are generated once each day (OOZ) for each ocean and are based on the Medium Range Forecast (MRF) model run with additional input from the European Center for Medium Range Forecasting (ECMWF), the United Kingdom Meteorological Office (UKMET), and the U.S. Navy's Fleet Numerical Meteorological/Oceanography Center (FNMOCC) forecast model guidance. The products depict surface isobars every 4 millibars with labeling of 2 digits in increments of every 8 millibars. The central pressure millibar values of synoptic scale lows and highs are displayed in bold three or four digits and underlined adjacent to or under

the "L" or "H." The previous 24-hour forecast position and future 24-hour forecast position of lows and highs are connected by vector arrows and displayed with an "X" and a "Circle with an X inside." A bold two digit millibar central pressure value underlined is placed under or adjacent to the 72/120-hour position label. The 96-Hour Surface Forecast also depicts wind speeds in knots (wind barbs in increments of 5 or 10 knots), and frontal systems (occluded, warm and cold). This medium range forecast tool can be used in conjunction with the 96- and 48-Hour 500 Forecast, Surface Forecasts and the 6- to 10-day 500-millibar Ensemble mean and Surface Storm Track Forecast products to determine initial route planning

or underway course/speed adjustments as well as aid the user in the decision making process for determining fuel consumption. The track history and forecast projection of highs and lows from 72 through 120 hours will serve to extend the time usage of the product, thus aiding the user in determining the risk to crew safety, and the need to avoid potential ship and cargo damage. The 120-Hour Surface Forecast is produced from the previous day's OOO MRF model run, if necessary as a replacement for the current OOO 96-Hour Surface Forecast if it is not available. This older forecast product will have the same forecast valid time as the current 96-Hour Surface Forecast would have had.



## Ship Awards and News

**T**he big PMO news this issue is that Dave Bakeman, PMO for Seattle, has announced his retirement effective in January (see page 40). We all wish Dave the best, and he will be missed. Marty Bonk opting for a warmer climate has transferred from Newark to Norfolk, Virginia where he will try to replace Ray Brown Jr. who is happily retired in Snow Hill, Maryland on the Eastern Shore. Meanwhile the New York and Newark PMO positions, which are now collocated have been vacant for awhile but should be filled by the time this issue hits the street.

Jim, PMO Houston, received this poem when he was visiting one of his vessels. The meteorological observation program aboard the ship had suffered a calamity and this tribute was to the culprit:

Ode to Dave

*Dear Mr. Met man  
I'm sorry to say,  
The Second Mate,  
Has made my day.*

*Whilst taking the sea temp.,  
He threw the bucket over the wall,  
And away it went,  
Rope an' all.*

*Luckily we have a second,  
Standing by,  
And as for the 2/O,  
His alibi....*

*...You must read it  
with a pinch of salt,  
But not just yet  
as we're coming to a halt.*

*So here we are, in the middle of the  
"oggin  
During which your Met. Log  
We are floggin'.*

*Time now for an Observation,  
Note the sea temp.'s an estimation*

*All being well, tomorrow mornin',  
We'll have a new bucket, but heed this  
warnin'*

*Make sure your bucket's securely fast,  
Or the stern of the ship you'll be seeing  
last.*

### Ship Awards

The following 10 pages contain pictures of some of the Outstanding Observing Awards presented to some of the top ships in both the U.S. and Canadian programs. These are the creme de la creme of weather reporters and while we kid around in the captions we are very proud of these dedicated crews for supplying observations that are vital to marine forecast programs worldwide.



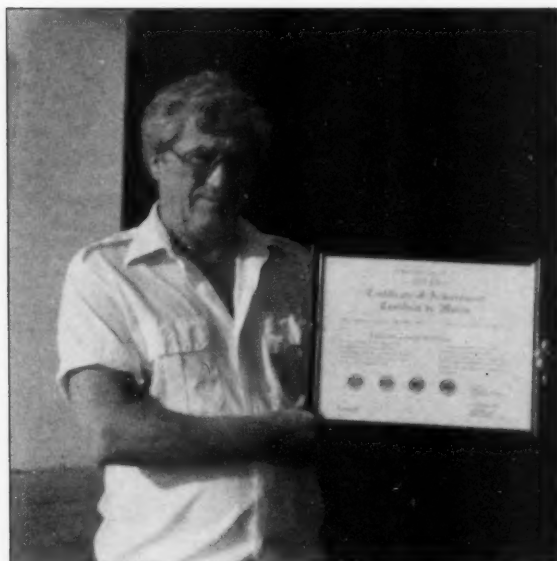
Jim Nelson, PMO Houston, enjoys the view on the wing of the **Sea-Land Atlantic** during his annual Familiarization Float. The ship traveled from the Barbours Cut Terminal in Houston, Texas to the Blount Island Terminal in Jacksonville, Florida. Jim was on board to assist (read get in the way) the mates in observing techniques. Photo taken by C/M Bruce Badger.



Canadian John T. White of the m/v **Algonorth**, a vessel of Algoma Central Marine, was one of the top 22 observers for 1993 in the Ontario Region VOS fleet. White is wearing a jacket awarded to the winners by Environment Canada and presented by PMO Keith Clifford at Hamilton, Ontario.



Above, Fred Randell, 2nd mate on the m/v **Canadian Century** receiving his VOS observer jacket. Randell, one of the 22 top observers in 1993, is a participant in the Canadian Great Lakes VOS program and an officer with Upper Lakes Shipping. PMO Clifford presented the award at Lock 5 on the Welland Canal.



Above, Captain Jack Van Os, aboard the m/v **Captain Henry Jackman**, holds his vessels' Certificate of Achievement with a 1993 Gold Seal Award presented by PMO Keith Clifford.

Above right, The crew of the m/v **Paul R. Tregurtha** holds one of two outstanding VOS participation awards given in



1993 by George Smith, PMO Cleveland. From left: 2nd Mate Gene Christiansen, Relief Captain Joe Buonocore, 3rd Mate Kevin Johnson. Not pictured are Captain Mitch Hallin, 1st Mate Connie Gilliam and 3rd Mate Kevin Johnson. Photo taken by PMO George Smith.



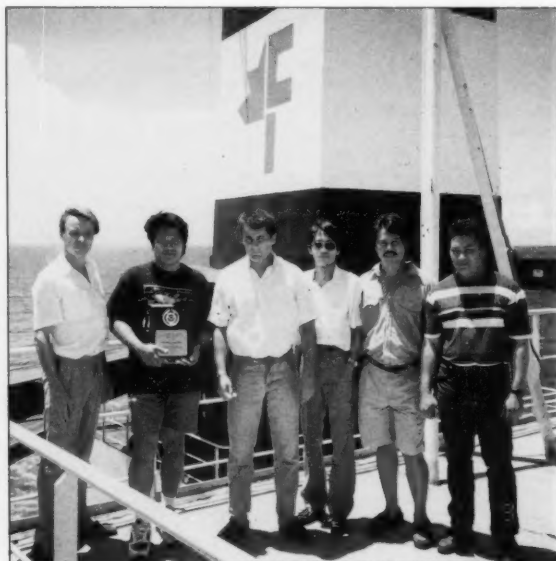
*Amy Broniarczyk, PMO Chicago, presents observing award to Captain Ralph Lewendowski (left) and Vaughn Steeker, 2nd mate (right) aboard the John G. Munson.*



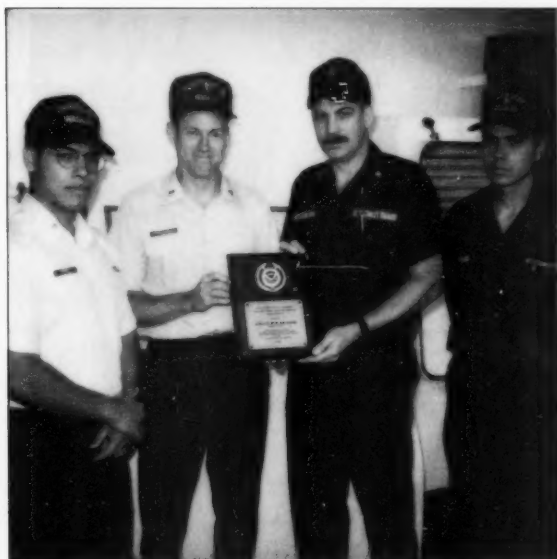
*Amy Broniarczyk, PMO Chicago, on board the Michigan, presents observing award (left to right) Junior Mate Chris Chadwick, Paul W. Shanabarger, AB, and Dan Davis, Lead AB.*



*L.L. Adams, 2nd officer of the Steward Cort receives an award for weather observations from Amy Broniarczyk, PMO Chicago. That's much more of a smile than Bob Collins the former PMO would have gotten. In New Orleans the m/v Federal Skeena*



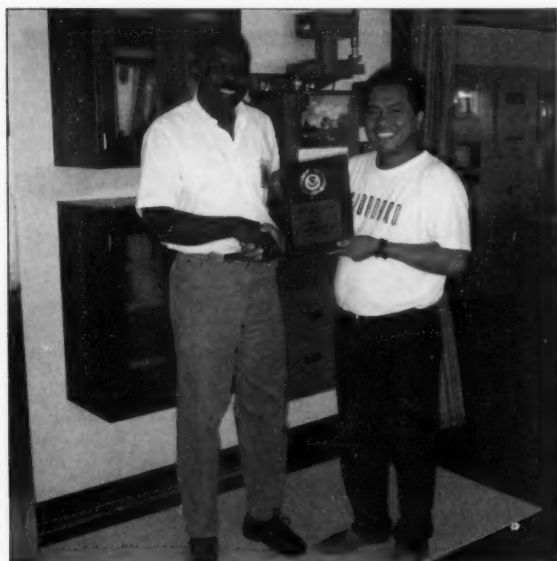
*receives a 1993 VOS Award. Left to right, Captain Marc Haentjens, Third Officer Reynaldo R. Bayot, Jr., Chief Officer Sven Deridder, R/O Ceferino Sangil, Second Officer Melchor Gabuco and AB Francis Milabo.*



Mariners aboard the USCGC *Polar Star* accept a 1993 VOS award MTS3 N. Rosario, MST1 J. Bartholomew, MST1 D. Hutchinson, and MST T. McDade presented by Dave Bakeman, PMO Seattle.



Quartermaster Bates and Quartermaster Winn receive their award for 1993 weather observations on board the USCG *Mellon*. Dave Bakeman, Seattle PMO and photographer, presented the award.



Baltimore PMO, Jim Saunders, congratulates Iniege O. Bagalay, Jr, 2nd Officer aboard the *Courtney L* for outstanding weather observations in 1993.

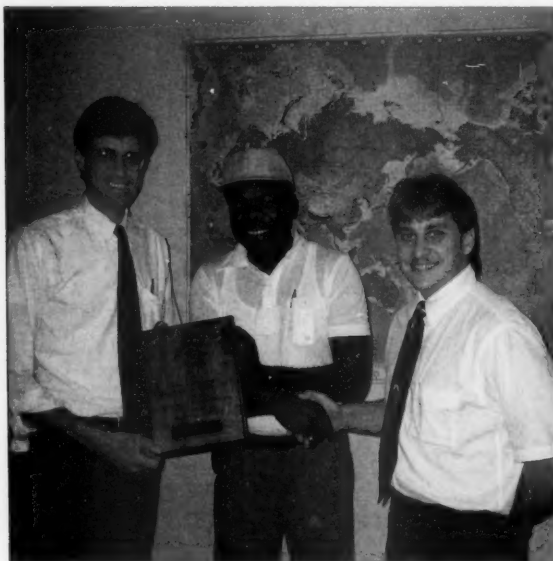


Jim Saunders, PMO Baltimore, presents award to the *Francis L*. In photo left to right, Jim, 2nd Officer Paulino Enriquez and Captain John Gladstone.



*Mike Madden of the Marine Transportation Division of Oglebay Norton Company is presented with an award in recognition of his pioneering efforts in digital fax and Digital Marine Weather Dissemination System (DMAWDS) technology in cooperation with the National Weather Service. Above from left*

*to right, Vice President Captain Gordon D. Hall (USCG Ret) Mike Madden, Bill Comeaux (Area Manager/MIC Cleveland, George Smith (PMO, Cleveland). The presentation took place at a luncheon sponsored by Lake Carrier Association in Cleveland, Ohio.*



*PMO Jim Saunders presents 1992 VOS award to J.E. Aspen Shipping Company. Pictured left to right is Secretary-Treasurer Steven Nutter, Jim, and J. Mark Aspens (Operations).*



*Jacksonville PMO Larry Cain, decked out in his NOAA uniform, congratulates Captain Eduardo A. Sica, Master of the m/v Sea Wolf for his weather observations.*



*PMO Jack Warrelmann presents the 1993 VOS award to the crew of the NOAA **Chapman** at Pascagoula, Mississippi. Left to right, Warrelmann, NOAA Fisherman Todd Wilson and LCDR Rick Brown.*



*Aboard the NOAA ship **Oregon II**, Pascagoula, Mississippi, PMO Jack Warrelmann (on left) gives a 1993 observing award to Chief Bos'n Cliff Pitarn, Lead Fisherman Roger Zirloit and Second Mate Jim Rowe.*



*Jim Nelson, PMO Houston, gives a 1993 company award to Captain Ben Bowditch of Lykes Bros. Steamship Company, Houston office. Captain Bowditch is the Manager of Marine Department, West Gulf.*



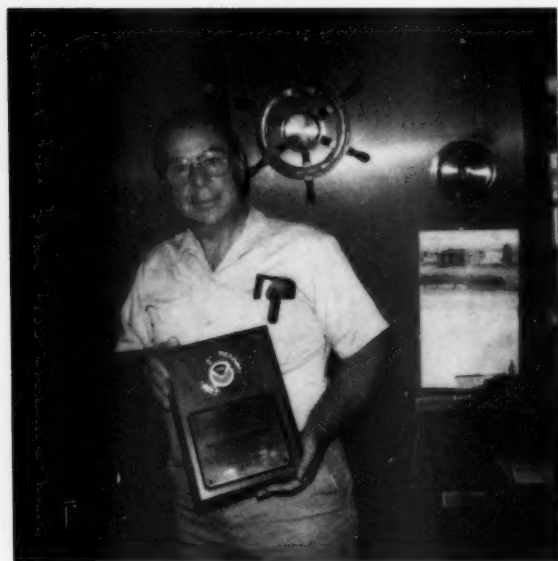
*The m/v **Tillie Lykes** receives an award for observation excellence in 1993. From left to right, Jim Nelson, PMO Houston, Cadet Chris Wilson from New York Maritime Academy and Captain Dean Nelsen.*



PMO Jim Nelson gives an VOS award for the Canadian PMO program to the m/v *Bibi*. From left to right are Chief Officer Sonjoy Joseph Sen, Captain Kawak Kapoor, Jim, and 2nd Officer Neil Kristan Mark Pereira. The *Bibi* is also one of our SEAS vessels taking Met and XBT observations from the U.S. to the Mediterranean.



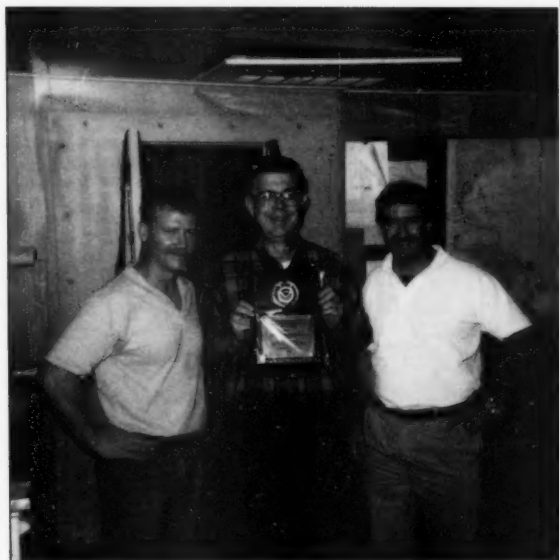
Bob Novak, PMO Oakland, presents an award to Captain S. Kisslinger of *Sea-Land Enterprise* for the 5th year in a row. Previous trophies are on the wall behind.



Captain Demos Kukeas displays the outstanding observations award plaque received for 1993. He accepted on behalf of his vessel the *Sea-Land Navigator*. It was their second such award.



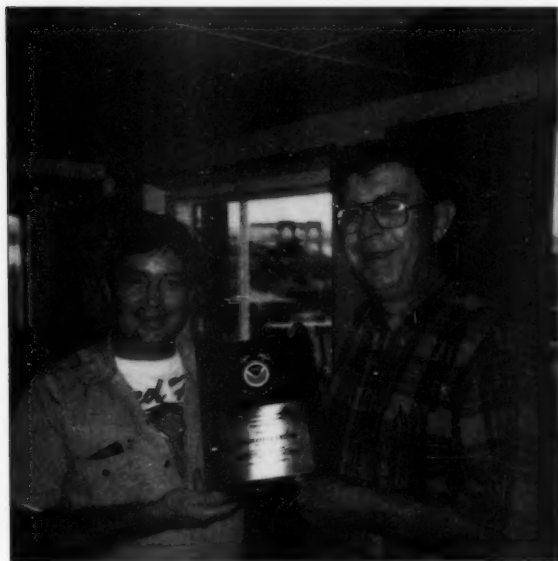
The crew of the mv *OOCL Inspiration* receive their 1993 VOS award. Left to right are Captain Eric Franzen, Chief Officer Mark Mahoney, Second Officer Dennis Sullivan, PMO Jim Nelson, Chief Engineer Louis Martucci. Photograph by Robert Snead.



Marty Bonk, PMO New Jersey, (middle) presents VOS plaque to Captains Dick Fitzgerald (left) and Orris Scribner of ITB Jacksonville. Marts was pinching hitting for Jim Saunders, BWI PMO (Rumor has it that Jim was asleep in his van).



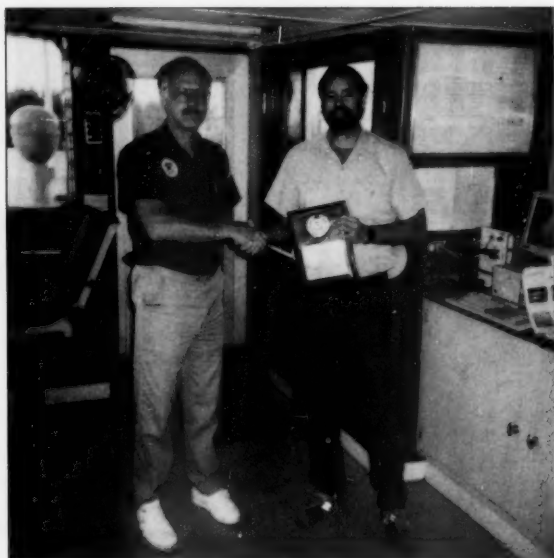
Joy Quinones of Stolthaven Terminal, Perth Amboy, New Jersey receives an Honorary VOS Plaque for her invaluable help with the VOS Program. PMO New Jersey, Marty Bonk presented the award. Bonk is attempting to catch Nelson as the most photographed PMO.



Standing in for Jim Nelson (PMO Houston), PMO Marty Bonk presents a VOS award plaque to 2nd Mate Tom Lewis of the Charlotte Lykes. Photo taken by C/M Chris Murray.



Marty Bonk (23 kilograms lighter since the first of the year), PMO New Jersey, presents an award to Maersk Company, Frank Harty (on right) for their contribution to the VOS program in 1993.



*Senator's Captain John J. McFadden (on right) accepts the VOS 1993 plaque from Charles Henson (PMO Miami). The Senator runs from the east coast of the U.S. to Costa Rica, Panama and South America as part of the SEAS program.*



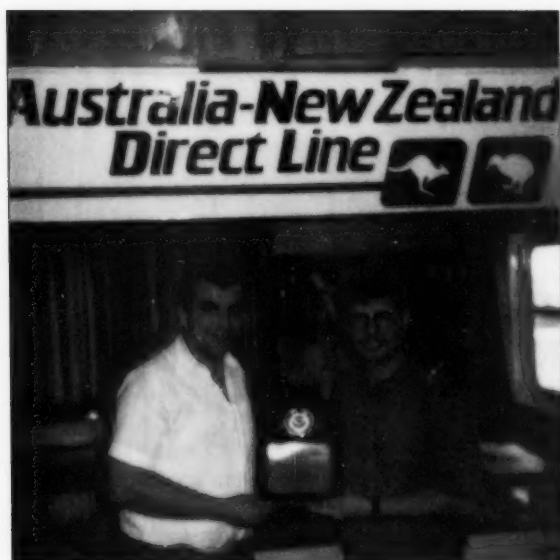
*PMO Charles Henson (Miami) presents award to Erwin Holder, Director of Marine Services of the Tropical Shipping Co., LTD for 1993 weather observations.*



*PMO New Jersey and New York City, Marty Bonk, presents VOS plaque to Captain Kovacio Savo of the Arctic Ocean for 1993 weather observations.*



*Charles Henson, PMO Miami, gives a VOS plaque to Captain Reno Rasmussen of the Seaboard Ocean. This vessel routinely runs from Miami to South America and the Caribbean.*



*Bob Webster (Long Beach) presents a VOS award to Chief Robert Gregorzyk of the Direct Kookaburra.*



*Chief Officer Rafael Montiel, 2nd Officer Benito Villegas and R/O Jose GPE Guan of the Toluca receive VOS award for 1993 from PMO Bob Webster.*



*On behalf of the Prince of Ocean, Chief Mate Alex Belisavio accepts the award for outstanding observations for 1993.*



*The Sea-Land Reliance received its first outstanding observation award for 1993. Accepting is Richard Domnitz.*



## Central Pacific Hurricanes—1993

*Staff, Central Pacific Hurricane Center  
National Weather Service*

**T**wo tropical depressions, one tropical storm, and two hurricanes affected the Central North Pacific in 1993. All occurred during July and August and except for Keoni originated in the Eastern North Pacific. This total of 5 was well below the 11 tropical cyclones that moved through the area in 1992, but represents an average season in the Central North Pacific region. The area covers the waters between 140°W and the International Date-line.

Although none of the tropical cyclones directly affected the Hawaiian Islands, the decaying stages of both Dora and Eugene resulted in significant rainfall mainly over sections of the Big Island and Oahu. In addition, Fernanda produced heavy surf on the eastward facing shores of the Hawaiian Islands and was accompanied by heavy thunderstorms.

### *Tropical Depression Dora July 19–20*

In the Eastern North Pacific, Dora was a potent hurricane sporting maximum sustained winds of up to

113 knots with a minimum pressure of 945 millibars. By the time it reached the Central North Pacific on the 19th, Dora had been downgraded to a tropical depression. It continued to weaken into a disturbance and finally dissipated as it tracked south of the Big Island on the 21st.

### *Tropical Storm Eugene July 22–24*

While traversing the Eastern North Pacific, Eugene peaked with maximum wind speeds of 109 knots and a low pressure of 948 millibars. By the time it reached the Central North Pacific, Eugene had dropped to tropical storm strength and continued to weaken. It moved westward at 15 to 20 knots and there was no significant convection associated with the tropical system as it tracked from 140°W to 160°W. Nearing the Hawaiian Islands, divergence aloft coupled with remnant instability from Dora was enough to trigger locally heavy showers and thunderstorms. A strong High remained entrenched to the north of Eugene during its westward journey and provided a brisk trade wind flow which

Eugene used to accelerate and move rapidly across the region. The last advisory was issued early on the 25th of July.

### *Hurricane Keoni August 8–19*

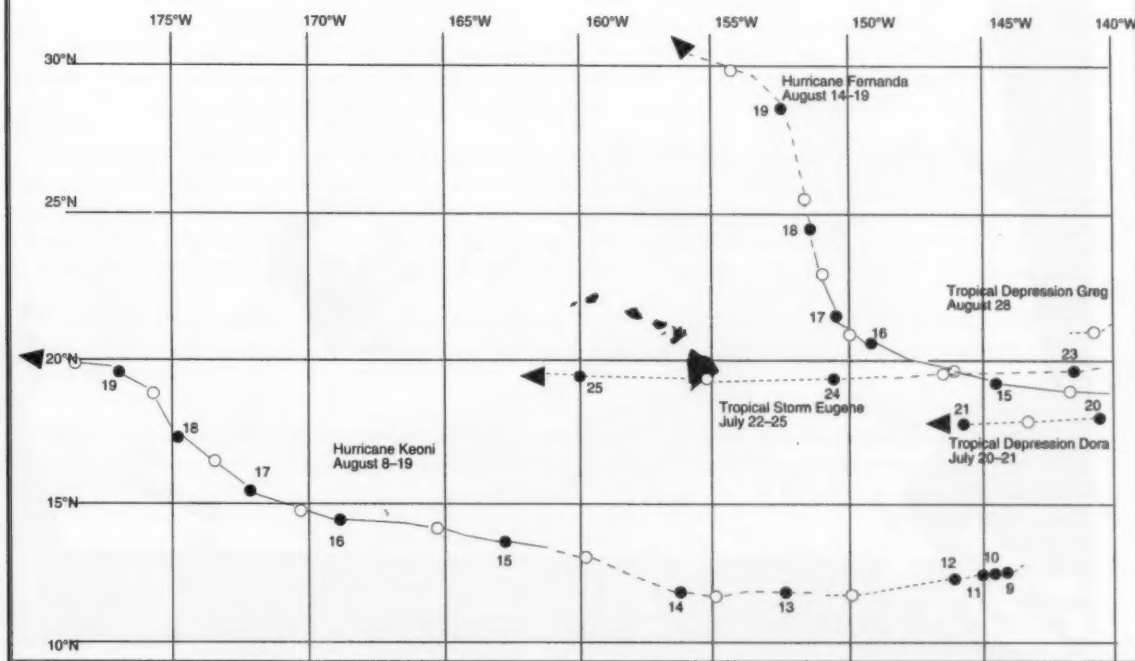
Keoni developed from a disturbed area, which moved westward along latitude 12.5°N. It crossed the 140th meridian on the 7th of August and was designated Tropical Depression ONE-C at 0000 on the 9th. The system was named Tropical Storm Keoni at 1800 on the 12th and reached hurricane status exactly 48 hours later. Keoni passed about 150 miles south of Johnston Island at 0600 on the 16th with winds estimated at 115 knots. Some 1,000 of the 1,100 people on the island had been evacuated to Honolulu 24 hours before the storm moved through the area.

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The staff of the Central Pacific Hurricane Center consists of Glenn H. Trapp, Armando L. Garza, Hans E. Rosendal, Benjamin Hablutzel and Andrew K. T. Chun.



## Tropical Cyclone Tracks—1993 Central North Pacific



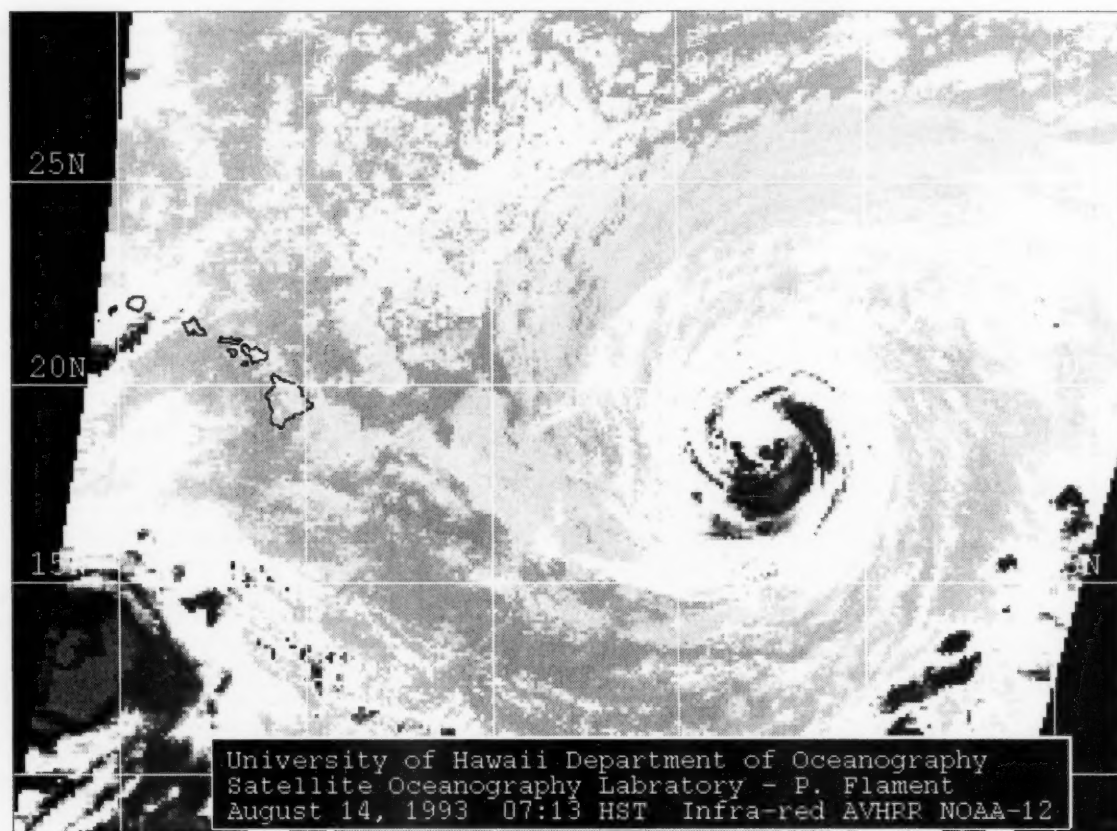
Heavy surf pounded Johnston Island, but since Keoni was a very compact, intense tropical cyclone, the effects of damaging winds and heavy rains were not felt on the island. Highest gusts reported were 39 knots. Keoni weakened somewhat after passing the island but crossed the International Date-line to become Typhoon Keoni late on the 19th. Once into the Western North Pacific, Keoni regained some strength but passed well north of Wake Island a couple of days later. The remnant circulation was still present well north of Wake Island in early September. Keoni remained at hurricane strength for 11 days making it the longest lived tropical system for the

Central Pacific area.

### *Hurricane Fernanda August 14-19*

Fernanda became a hurricane on the 10th of August in the Eastern North Pacific. It peaked on the 12th when maximum sustained winds reached 125 knots. Fernanda was still a well-developed hurricane when it entered the Central Pacific on the 14th at 0600. Maximum sustained winds were 85 knots down from 115 knots 24 hours earlier. Fernanda continued to weaken for the next few hours but began to reintensify as it approached the Hawaiian Islands

where slightly warmer water temperatures and more favorable wind shear provided additional energy. Fernanda, at its closest point of approach, was about 300 miles northeast of the Big Island of Hawaii early on the 16th. Its maximum winds were 90 knots at this time. A Tropical Storm Watch and High Surf Advisory were issued for the Big Island as Fernanda continued to approach. On the 15th, a Hurricane Watch was issued for all the islands as Fernanda was 410 miles east of Hilo. A High Surf Advisory continued as surf of 5 to 8 meters (15 to 25 feet) was predicted on eastward facing shores. The Hurricane Watch was upgraded to a Hurricane Warning for the



Big Island in the late afternoon of the 15th. The following day Fernanda stalled some 280 miles east northeast of Hilo. Later in the day it came under the influence of an approaching trough and began to turn toward the northwest. In addition westerly wind shear ahead of the trough began to weaken the hurricane. Fernanda, continuing to weaken, drifted northward and all watches were dropped in the evening of the 16th. By the 19th, as it crossed the 30th parallel, Fernanda had turned extratropical. Ships in its path were still reporting gale force winds as the remnant circulation moved across the shipping lanes and merged with a frontal system on the 21st.

In the Hawaiian Islands,

heavy surf of 3 to 5 meters pounded the eastward facing beaches of the Big Island with some 5- to 6-meter waves reported on Kauai. Shoreline roads along the eastern shores sustained some damage on all islands and some homes were flooded.

### *Tropical Depression Greg August 27-28*

Former Tropical Storm Bret in the Caribbean was revived in the Eastern North Pacific as a tropical depression on the 15th of August. This depression eventually became Hurricane Greg and its maximum sustained winds reached 113 knots. However, as Greg moved into the

Central Pacific on the 28th it was as a weakening tropical storm. At this time a 1033-millibar stationary high pressure system was centered near 40°N, 140°W. It was well entrenched and the surface gradient supported 20- to 35-knot winds north of the tropical storm. Greg was able to create a deformation on the south side of the High but was unable to break it sufficiently to track any farther north than 21°N. At 0900 on the 28th, Greg was generating maximum sustained winds estimated at 35 knots, but was showing signs of continued weakening. Some 12 hours later it had dropped to depression strength.

### *In Memory of Mike Coombs*

It is with much sadness that we who remain in the Marine Division of the British Meteorological Office have to advise his many former friends in the National Weather Service, of the death of Captain Mike Coombs on 2nd October last.

Mike was indulging in his recently acquired skill of bell-ringing at his local church in South London, when he had a heart attack and died instantly, within days of his 66th birthday. Coming a mere 9 months after his retirement, following 10 good years serving the Met. Office Marine Division, the news of his passing came as a great shock to his former colleagues.

Mike spoke often of the many friends he made from the U.S. contingent at the International PMO's Seminar in London in September 1993, and how good it was to maintain such a harmonious and fruitful liaison over the airwaves afterward. He was never happier than when he was able to talk on the telephone to Jim Nelson or Ray Brown when arranging for the issue of some item of equipment to a ship expected in a U.S. port. This international liaison was an aspect he was always keen to foster, and he made great progress in that field in his time in the Met. Office.

Following his 36 years at sea in the British Merchant Navy, having a keen weather observing record, the last 20 years of which was as Master of mainly refrigerated cargo ships, Mike found a suitable niche in his final career, putting much effort into the personal approach, persuading colleagues overseas to service other countries' ships whenever possible. Unfortunately, he came ashore within a year of two of becoming eligible for presentation with a long-service barograph award, which would have been fair recognition of his successes.

Mike will be missed by all, not least by his wife Pat, by his two married sons and four grandchildren, for all of whom he was always ready with practical help and advice, and our sympathy goes out to them at their time of loss.

Captain John Houghton

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## Some Thoughts on Facsimile Charts and Weather

*Bob Novak  
PMO, Oakland*

**T**his year I took a familiarization trip aboard the training ship *Golden Bear* of the California State Maritime Academy. I boarded the vessel in Honolulu, Hawaii and departed in Kodiak, Alaska, in between there were 12,600 nautical miles of travel. The vessel was commanded by Bruce Butterfield on loan from the Military Sealift Command (MSC), with a total of 200 students and 50 crew members on board. We had fair weather and trailing seas for 90 percent of the voyage, but there were 3 squally days of weather. On May 21st (24.9°N, 163.3°E) we observed several funnel clouds. On the 23rd we went through a squall line, but the most interesting weather event occurred on the 24th of May near 24.8°N, 145.9°E when we went through and around numerous showers and thunder-

storms. At 0000 on the 24th, a classic waterspout accompanied by at least seven other funnel clouds was observed. At 0300 we entered a squall that reduced visibility to near zero with a 43-knot wind. The whole event lasted less than 2 minutes. No associated weather feature showed up on either the United States (NMC) or Japanese (JMH) facsimile maps.

The next period of inclement weather occurred in the form of restricted visibility either due to dry haze or dense fog. The dry haze which was observed in the northern South China Sea and the southern Yellow Sea produced the most ominous looking blood red sunsets. Periods of mostly nighttime dense fog (visibilities less than  $\frac{1}{2}$  mile) were observed from the time we entered the Sea of Japan on June 5 until we reached the extreme northern part of the

North Pacific, just east of the Kamchatka Peninsula on the 11th.

I was able to experience the use of weather facsimile charts firsthand during this voyage. One of the major complaints of mariners over the years concerns the timeliness of the JMH products versus that of NMC. The start time of the JMH products was always on the minute while the NMC times started either a few seconds late or in some cases early. Not all the JMH charts came in synchronized, but the problem occurred less frequently than it did with the NMC charts. I received one notice that there was a problem in Washington due to the moving of equipment. In fact, on the 13th of June no charts were received at all from NMC, but we did receive NOJ, Kodiak.

The JMH facsimile schedule lists numerous rebroadcasts of



*Despite the fact that the weather on Novak's voyage was mostly good to excellent, he was able to shoot a fair number of good marine*

*weather photos. This is a beautiful shot, particularly in color, of one of the thunderstorms they experienced on his Pacific voyage.*

the same product although only the surface chart was rebroadcast. For example, the 0440Z wave height analysis is rebroadcast at 0537Z only if the 0440Z is not made.

NMC has an excellent product which is timely and easy for the mariner to use. It is our delivery system that seems to be the weak link. Going west we received transmission from NMC until 24.6°N, 158.4°E. Going east the broadcast was picked up near 42.6°N, 132.9°E.

The forecast maps beyond

24 hours from JMH only contain isobars and precipitation, but no fronts. This makes it difficult for the mariner to determine continuity out to 120 hours. The NMC charts carry the frontal zones. On this trip both NMC's and JMH's long range surface products verified very well. Most impressive was the large area of high pressure over the Bering Sea from the 10th through the 19th of June which started appearing on the charts on June 5th.

The 500-millibar charts

produced by both NMC and JMH indicated little differences in atmospheric patterns. They both have highlighted isoheights. However, JMH has the 5700 meter highlighted while NMC features the 5640-meter line. NMC's rationale is that this line is used to approximate the southern extent of force 7 winds in winter and force 6 winds in summer. A mariner could easily confuse the two highlighted isoheights which may lead to misleading conclusions when using the JMH charts.



*All times unless noted are UTC (universal time) and all miles are nautical. For additional detail, tropical cyclones will be covered in the annual reports from the tropical cyclone centers around the world. The weather summaries are based upon the track charts and Northern Hemisphere Surface Charts as well as ship reports, and attempt to highlight the most significant ocean features each month. The track charts are provided by NOAA's National Meteorological Center. If an extratropical storm is particularly bad for shipping, we may designate it as the Monster of the Month. The Gale Tables provided by the National Climatic Data Center at Asheville, NC, have been expanded to include U.S. ships reporting winds of 34 knots or more.*

## North Atlantic Weather April, May and June 1994

**A**pril—The Atlantic is often a war zone as the Azores-Bermuda High battles the Icelandic Low for control. Eventually the High wins the spring battle but not without a fight. This April both climatic features were more intense than normal, and the Icelandic Low was forced to take up residence over the Greenland Sea. The upper level steering currents were oriented toward the east northeast but tended more toward the northeast near Europe where a trough was evident on the upper level charts.

The month began with a large, complex low pressure system dominating the waters east of 25°W. Actually a 966-millibar center was located over England with a 950-millibar center just southeast of Iceland. The *Star Drottanger* near the Bay of Biscay ran into 50-knot winds in 8-meter swells. Most vessels and platforms in the Irish Sea, English Channel, North and Norwegian Seas were experiencing force 8 to 9 winds with seas in the 5 to 8 meter range. These conditions also extended over the

northeastern North Atlantic. As the day wore on storm force winds reports were on the increase. At 1500 on the 1st, the platform 62414 (53.8°N, 2.9°E) measured 60-knot west southwesterlies.

Conditions didn't improve over the next few days as gale to storm force winds continued to buffet these waters. At 1500 on the 3rd, the OZJP2 (63.1°N, 18.9°W) was rattled by 52-knot westerlies in 9-meter seas and 3 hours later the platform 63120 (60.7°N, 1.0°E) reported a 50-knot southerly in 4-meter seas. One center looping over Iceland plunged to a 954-millibar reading at 1200 on the 4th. This was a potent winter storm situation. The weather finally began to improve on the 5th.

A large semi-permanent High was slowly taking control of the North Atlantic on the 6th and 7th. It was centered southwest of the Azores, but its influence was left from Bermuda to the Bay of Biscay. It forced a weak Low to travel up the East Coast of the U.S. while several moderate centers moved between England and Iceland. The East Coast Low intensi-

fied on the 9th as it neared Kap Farvel with its central pressure dipping to 976 millibars. It was potent enough to cause some gales over the northern shipping lanes. At 1800 on the 9th, the *Constance* hit 48-knot easterlies near 60.2°N, 33.8°W. The storm filled as it moved rapidly northeastward on the 10th and 11th.

On the 13th, a Low which had its beginnings over Hudson Bay organized into a 976-millibar system just south of Kap Farvel. It was short-lived, however, as were many of the systems during the mid part of the month. However on the 15th and the 16th, a 985-millibar Low moved across Lake Superior creating a few problems in the western Great Lakes where ice was still plentiful. The *Paul Tregurtha* (47.7°N, 88.8°W) at 0300 on the 16th ran into 42-knot northerlies in 2-meter seas while reporting a 988.5-millibar pressure. At 2100 the *Alpena* (44.6°N, 87.8°W) caught a 45-knot northerlies in 1-meter seas. The storm slowed as it moved north of the Great Lakes prolonging the rough weather for a couple of days. On



the 18th at 0000 both the *Edwin Gott* and the *Burns Harbor* near the Straits of Mackinac encountered force 9 winds in 1- to 2-meter seas.

In the meantime a bubble of high pressure developed over Greenland and spilled out into the Atlantic effectively splitting the low pressure systems into their two regions for a time. This also kept them from developing into potent storms. Aided by a large High to the south, weather conditions remained relatively passive until about 23rd when a 976-millibar Low intensified southwest of Ireland. Even this was short-lived and high pressure systems seem to abound until the last day of the month.

Just before April came to a close, another Hudson Bay Low briefly intensified south of Kap Farvel. By 1200 on the 29th, it had dipped to 968-millibars and plunged to 964 millibars just 12 hours later. The GZMM (48.8°N, 42.6°W) was blasted by 52-knot westerlies while battling 10-meter swells at 1200 on the 30th. The *OOCL Assurance* (48.7°N, 42.9°W) struggled against 15-meter swells in 48-knot westerlies at the same time. The UDUR was running into similar problems. These vessels were facing weather that was unusual for the end of April and reporting in conditions that would make most seasick.

**Casualties**—The mv *Tabasco*, one of the Voluntary Observing System's best reporting vessels, was lost at sea on the 16th of April near 29.9°N, 35.0°W. Fortunately, all 23 crewmembers were rescued by the mv *Winter Wave* after a hole was discovered in the number 3 hold in

force 8-9 winds and heavy swell. This was the first ship in NOAA's SEAS program to be lost.

On the 4th, the 1,652-ton *Elatma* with 11 people on board sank in heavy seas off the Dutch coast in the North Sea. All were rescued by a Belgian Navy helicopter. In New York harbor in dense fog, the 195-meter *Jean Lykes*, with two pilots aboard, sustained minor damage when it plowed into the stern of the anchored *Petrobulk Lion* on the morning of the 13th. The 68-ton offshore supply vessel, *Lady Esther*, loaded with nearly 100 tons of 10-centimeter chain capsized at the mouth of the Mississippi as it emerged from South Pass and encountered 2-meter seas head-on.

On the Great Lakes and in the St. Lawrence Seaway, ice problems were regarded as the worst since the winter-spring 1978-79. The 22,852 bulk carrier *Algolake* sustained a 1-meter gash in the starboard bow from ice in the St. Mary's River on the 9th. On the 3rd, jagged ice in the Lake Michigan approach to the Mackinac Straits punched an 46-centimeter hole in the port bow of the *Burns Harbor*. The next day, the *Algoway* tried to fight its way to the Straits from the Lake Huron side and sustained a 61-centimeter hole in its starboard side. On the 7th, the bulk carrier *Federal Thames* sustained ice damage making way upbound in the St. Lawrence River.

**M**ay—By this month the Azores-Bermuda High has taken control on the North Atlantic Climatic Chart. This May was no exception although in the

Bay of Biscay and approaches to the English Channel as well as the Gulf of St. Lawrence and its approaches, mean surface pressures were lower than normal. This was reflected at the 500-millibar level where troughing was noticeable in both these areas disrupting any zonal flow patterns.

The month began with a 977-millibar Low south of Kap Farvel generating near gale to gale force winds close to its center. However, the system weakened the following day joining several other weak Lows over the northern shipping lanes. A huge 1034-millibar High dominated the North Atlantic south of about 45°N with little inclination to move. One of the weak Lows from the Gulf of St. Lawrence intensified on the 5th on a northeastward heading south of Kap Farvel. The SLCI some 340 miles south of the center registered 47-knot westerlies in 4-meter swells. At 0000 on the 6th, the *Sanko Pageant* (56.8°N, 15.0°W) hit 45-kn southwesterlies as the 972-millibar Low skirted to the south of Iceland and stalled. The storm slowly filled but remained a weather-producer into the 8th.

The large High to the south helped create a tight pressure gradient on the 9th as a 986-millibar Low slide by between 50° and 55°N. The strongest winds occurred between 40° and 50°N from 20° to 40°W with several vessels reporting gales including the OXMB6 which was buffeted by 7-meter swells. This storm weakened as it headed for England. Numerous weak to moderate Lows were either forming in or affecting the Gulf of St. Lawrence area during the first half of May.



On the 12th, a large 988-millibar Low was dominating the seas east of 30°W including the English Channel and Bay of Biscay. It was obvious that the semipermanent Azores High was splitting the cyclonic activity in half. For example, on the 14th a 990-millibar Low as centered over Nova Scotia and a 995-millibar Low was located just west of Cape Finistère. In between a 1044-millibar High over Greenland was connected to a 1027-millibar center near 30°N, 40°W. Conditions were slow to change. Eventually the Nova Scotia Low broke through the block and another weak Low filled in behind it. The center of the High was forced to the south. Several of the low pressure centers found their way over England to help contribute to the anomalous situation that developed on the climatic charts. Most of these storms were more of an annoyance than a real threat to navigation. However, even weak to moderate systems can generate gale force winds and rough seas. For example, at 0000 on the 23rd, the DQFX (44.0°N, 43.0°W) southwest of the 990-millibar Low ran into a 45-knot northwesterly in 2-meter swells. This pattern of a large High to the south and weak to moderate Lows north of 45°N continued till month's end.

**Casualties**—The tanker *World Pendant* was discharging a cargo of crude oil at Fos early on the 14th of May in force 7 to 9 winds. The vessel broke the mooring lines and severely damaged terminal equipment.

**J**une—The Azores-Bermuda High was dominant on the climatic charts this month. However, north of 55°N a remnant of the Icelandic Low stretching from Greenland to the Baltic and Barents Seas indicated above average cyclonic activity. This was also reflected on the mean 500-millibar chart with a broad trough covering these areas and influencing the movement of surface Lows north of about 50°N.

The month began with a huge 1032-millibar Azores-Bermuda High centered near 35°N, 45°W. Along its northern periphery, a small Low scooted along the 53rd parallel and intensified as it neared Ireland on the 3rd. Its strength was indicated by vessels such as the *Charles Darwin*, *Cotswald*, FNDE and *Dusseldorf Express* which were encountering gale force winds in 4- to 5-meter seas. These conditions continued into the 4th in the English Channel and North Sea and finally eased on the 5th.

A number of weak Lows made their way from Newfoundland and into the Norwegian Sea during the second week of June as a 1038-millibar anticyclone established itself over the northeastern North Atlantic providing protection to the Bay of Biscay, English Channel and North Sea. Several of the Lows were forced into the Denmark Strait. In essence this created a nearly stationary frontal boundary which stretched from the northern coast of Norway southwestward into the subtropics of the North Atlantic. Waves formed along or near this boundary and travelled northeastward. This continued into mid month before another High began to wedge its way in from the west. For several days the

North Atlantic was dominated by this High. Cyclonic activity was confined to the Denmark Strait, Labrador Sea and Baffin Bay.

On the 18th, a 976-millibar Low just south of Iceland influenced weather over the northern shipping lanes and even into the Labrador Sea. Along with a second center from Hudson Bay, this Low became a sprawling mass which pushed the large High south of 40°N. On the 19th, one of the Low centers was just south of Kap Farvel and the other off the coast of southern Norway. A front from this center extended southward across Scotland and then swung westward across Ireland and over Nova Scotia and the Great Lakes. This setup persisted for several days with sporadic near gale force winds along the front.

During the last part of the month, another High became established over the Azores and once again Lows from the Midwest and southern Canada were forced northeastward. The pressure gradient between them and the High was often tight enough to generate near gale force winds. Towards the end of June, the High slipped southward leaving England and the North Sea vulnerable to the weak to moderate Lows traversing the North Atlantic.

**Casualties**—The tug *Oliver L. Moore* and the barge *McKee Sons* were attempting to tie up at the Bay City Aggregate Company pier in the Saginaw River near Bay City, Michigan on June 25th. Strong currents due to recent heavy rains caused the stern to swing around resulting in the 620-foot vessel completely blocking the river. It was finally freed on the 27th.



Conversion Helper										
meters	1.5	3.0	4.6	6.1	7.6	9.1	10.6	12.2	15.2	18.3
feet	5	10	15	20	25	30	35	40	50	60

## North Pacific Weather April, May, and June 1994

**A**pril—The subtropical North Pacific High came up weaker than normal on the climatic charts as did the Aleutian Low. This is definitely an indication that this was the basin to sail in April, in general. That's small consolation for those who ran into the few gale or storm force winds that arose. The steering currents in the upper atmosphere on average were nearly zonal—parallel the lines of latitude.

It's not that there were a lack of low pressure systems over the North Pacific, it's just that they were either short-lived or weak. During the first week at least one-half dozen centers were tracked and only one dipped below 980 millibars, briefly. Of course, Lows and their associated fronts

can generate gales without the aid of very low pressure centers. For example, a 984-millibar Low east of the Kuril Islands on the 3rd was creating problems along the routes to and from Tokyo. Force 9 winds and 3- to 6-meter swells were being encountered by such vessels as the OYSN2, *Seal-Land Voyager*, DQFX, and the *Pervomaysk*. At the same time east of the dateline, the 976-millibar Low (45°N, 165°W) was pounding the 3EJX9 (51.0°N, 161.6°W), the *California Luna* (41.6°N, 174.4°W) and the JMQN (52.4°N, 170°W) with similar fury. And to the south of the Central Philippines lurked Typhoon Owen. At 0000 on the 5th, the AOV (15.0°N, 126.5°E) ran into a 60-knot north northeasterly.

At 1200 on the 8th, there were five distinct low pres-

sure centers with only a few gale reports. A few days later one of these centers moved northeastward and developed into a moderately intense Low which covered the Gulf of Alaska and northeastern North Pacific. The *Fir Grove* (47.2°N, 126.9°W) reported a 58-knot westerly at 0000 on the 10th. Six hours later the *Nova Gorica* (50.0°N, 153.3°W) battled 9-meter seas while being blasted by 50-knot westerlies. The Low intensified to 974 millibars as it slowed and stalled. However, on the 11th, it began to weaken.

A 975-millibar Low from the Bering Sea entered the picture on the 11th and between the two systems travel along the eastern Aleutians and in the Gulf of Alaska remained hazardous at best. At 1800 on the 11th, the



NAQD (54.9°N, 164.3°W) ran into a 50-knot north northwesterly while the JPGO battled 10-meter swells in 48-knot westerlies. These conditions continued the following day as the *Lerma* (54.1°N, 161.0°W) reported 53-knot westerlies in 9-meter swells.

Meanwhile in the western ocean, a large 976-millibar Low centered over Sakhalin Island was generating force 8 and 9 winds along with 6- to 8-meter seas along the northwestern shipping lanes. The *President Tyler* (45.5°N, 150.2°E) at 0000 on the 13th measured a 48-knot south southeasterly and the ELNV8 (43.6°N, 148.6°E) was belted by 48-knot winds in 5-meter seas. This Low actually moved up the Island and into the western portion of the Sea of Okhotsk. A couple of large high pressure centers exerted an influence over the next week or so until a system southeast of the Kamchatka Peninsula began to intensify on the 19th.

This Low developed in the Sea of Okhotsk and moved eastward. At 1200 on the 19th, its central pressure dipped to 980 millibars near 50°N, 165°E. In conjunction with a 1026-millibar High to the south, this created a tight enough pressure gradient to generate gale to storm force winds and 5- to 9-meter seas over an area between 40°N and 50°N from the Kurils to the dateline. Vessels such as the OULL2, *OOCL Envoy*, ELQB8, *Transworld Bridge*, and JPUV confirmed these numbers. These conditions prevailed through the 20th.

The remainder of April was similar. Several weak to moderate lows would flair up briefly and create gales for a short period

of time but none were able to organize into a potent system.

**Casualties**—On April 4th the ro-ro ferry *Dona Cristina* ran aground at Mandave, Cebu in the central Philippines during Typhoon Owen. In Jakarta, off Bali, (south of the equator) the ro-ro/landing craft *Kaltin Mas II* capsized in rough weather on the night of the 19th. The vessel, reportedly swamped by huge waves, was carrying about 70 passengers and a crew of 5. It was reported that 11 bodies were recovered along with 25 survivors.

The Royal Observatory, Hong Kong reported that Owen swept through the central Philippines as a severe tropical storm on the 3rd killing three people with another four reported missing.

**M**ay—The subtropical North Pacific High was normal on the monthly mean sea level pressure chart while the Aleutian Low centered over the Alaska Peninsula was deeper than normal. At the 500-millibar level, a trough extending from the Sea of Okhotsk to the South China Sea and another extending from the Alaska Peninsula southeastward to about 35°N were the major features on this climatic chart. A slight ridge over the Kamchatka Peninsula was also a factor in the steering currents.

While the month opened with a messy string of weak Lows across the Pacific, it wasn't until the 4th when a 980-millibar Low came to life southeast of Adak Island in the Aleutians that some real weather began to plague the

northern shipping lanes. Vessels such as the *President Tyler*, *Sea-Land Innovator*, KRJG and *Ryofu Maru* were encountering 40- to 45-knot winds and 5- to 8-meter seas. The storm remained potent through the 5th as it moved up the Alaska Peninsula and harmlessly inland.

On the 8th a 982-millibar Low heading into the Gulf of Alaska after crossing the 50th parallel near 146°W briefly generated some strong gales in the vicinity of 50°N, 137°W. This intensity was testified to by the *Chevron Mississippi*, EL0T3, 8HFN and the KLVH. They also ran into 3- to 4-meter swells.

A storm developed off Tokyo on the 12th and headed northeastward. AT 0000 on the 14th, its central pressure dipped to 960 millibars as it crossed the 50th parallel near 172°E. This was a potent storm for May. Ships in the vicinity were encountering strong gale force winds in 5- to 6-meter swells. For example, the *Nova Gorica* (44.2°N, 175.9°E) reported 44-knot west southwesterlies in 6-meter seas while the *Fir Grove* (50.0°N, 173.6°E) measured a 968.0-millibar pressure. Reports were also received from the ELME 2 and *Green Lake*. Fortunately, the storm began to weaken later on the 14th as it moved through the Aleutians. To the south, Page was on its way to typhoon strength which it achieved by the 15th.

Another moderate Low showed up near the Alaska Peninsula on the 19th. With a 975-millibar center, it was generating some strong gale force winds. Early on the 20th ahead of its associated cold front, the ELHC2 and *Star Langanger* ran into 42-knot



southerlies and 45-knot southwest-erlies respectively. Later in the day, the system began to weaken although it was replaced by a 980-millibar Low a couple of days later. This continued the progression of weak to moderate Lows that comprised the climatic Aleutian Low which was centered over the Alaska Peninsula this month.

During the final week of the month, a pair of large subtropical Highs dominated a good portion of the Pacific. But they did not prevent several more Lows from moving into the Gulf of Alaska.

**Casualties**—The 1599-ton tanker *Damansara* collided with the bulk carrier *Ming Wisdom* during a thunderstorm 6 miles off Kukup, Johore State, Malaysia on the 9th. The *President Washington* was severely damaged when it was hit by the 35,000-ton containership *Hanjin Hongkong* in patchy fog outside the Port of Pusan, South Korea late on the 2nd. The *President Washington* was rolled to starboard by the impact as containers were thrown from its deck, six ending up on the bow of the *Hanjin Hongkong* and many more went overboard. A subsequent fire caused further damage to the President Lines vessel.

**J**une—The climatic chart for the month looked very close to normal over the North Pacific. At 500-millibars, flow was nearly zonal south of about 50°N. There was a trough just off the coast of North America, another extending from Kamchatka to Honshu and a slight one near the dateline. All three provided

minor blips in the zonal flow.

The month opened with a large double-centered High in the midPacific and a 995-millibar Low in the Gulf of Alaska. This situation remained fairly static for several days as the Gulf of Alaska Low weakened. It wasn't until the 5th that a Low, which had come to life on the 1st southeast of Shikoku, organized over the Aleutians into a potent system with a 980-millibar center. It generated a few near gale force wind reports and one unsubstantiated report of a 64-knot west southwesterly on the 6th. After crossing the Aleutians, the system made its way back out into the Pacific on the 7th and although weakened it retained an identity until the 11th in the Gulf of Alaska. At this time, a stationary front stretched from the Gulf of Alaska southward then west southward into the East China Sea. There were at least four identifiable atmospheric waves along the front but none were significant weather producers until the 12th when an organized system was detected near 45°N, 147°W. This 984-millibar Low was quickly noticed by vessels in the area. The *George Washington Bridge* (45.6°N, 149.5°W) at 0600 ran into 44-knot northerlies in 2-meter seas while nearby the *President Truman* hit 42-knot winds in 6-meter seas. At 1200 the KASJ (47.2°N, 133.5°W) measured 40-knot southerlies in 5-meter swells. The system continued east northeastward and ended up just north of Vancouver Island on the 13th.

On the 15th, a huge multiple-centered High blocked most of the North Pacific and a 987-millibar Low over the Kurils was vainly attempting to move

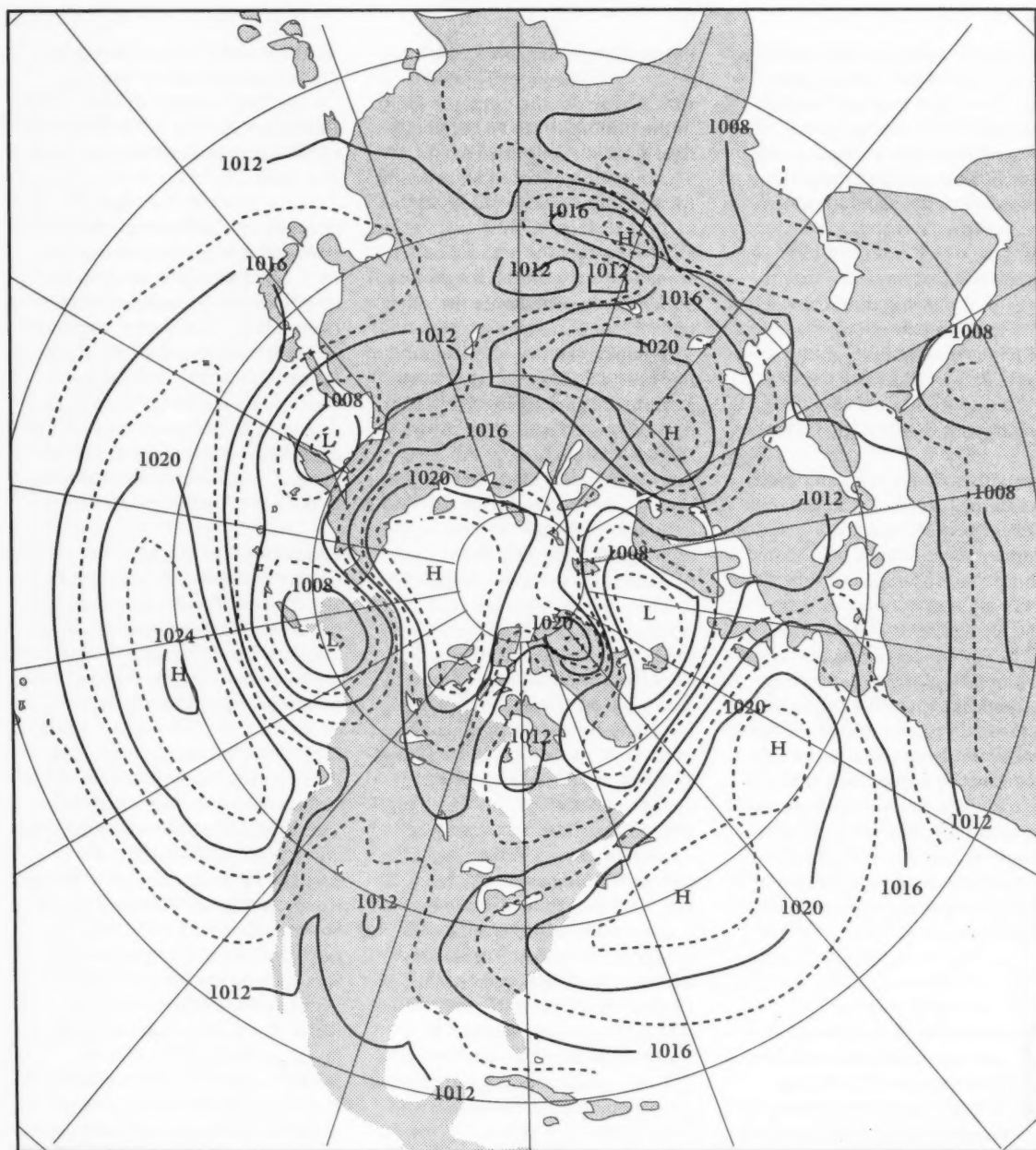
northeastward. It was forced into the Sea of Okhotsk on the 16th. On the 15th at 1200, the *Sea-Land Developer* (44.3°N, 155.7°E) reported 54-knot southeasterlies at 1200 and 1500.

While the High eventually split into several separate systems and low pressure areas were once again plentiful, none were able to become dominant. The closest to a major system organized on the 28th just east of the Kuril Islands. This 986-millibar Low which had formed off Tokyo just 2 days earlier was heading toward the Aleutians. It was able to produce some strong breezes but little else as the month came to an end.

**Casualties**—On the 13th, the 64-meter *Atlantis II* operated by Woods Hole Oceanographic Institution was attempting to cross the Yaquina Bar when a large wave crashed over its stern sending water cascading into the steering compartment. Subsequent waves created additional problems but the captain quickly regained control and was able to avert disaster. The 15,979 ton *Ionian Sun* suffered an engine breakdown in stormy seas 150 kilometers south of Hong Kong on the 5th. On the 7th, the *Southern Opal* (21.8°N, 112.9°E) reported cargo leakage in rough seas. These two incidents were associated with Tropical Storm Russ. The *Ionian Sun* was finally towed to Hong Kong and the *Southern Opal*, some 96 miles from Waglan, anchored but the crew could not be evacuated until the 9th because of the weather. On the 19th, the *Royal Pusan* (35°N, 129°E) dragged anchor and grounded in strong winds.



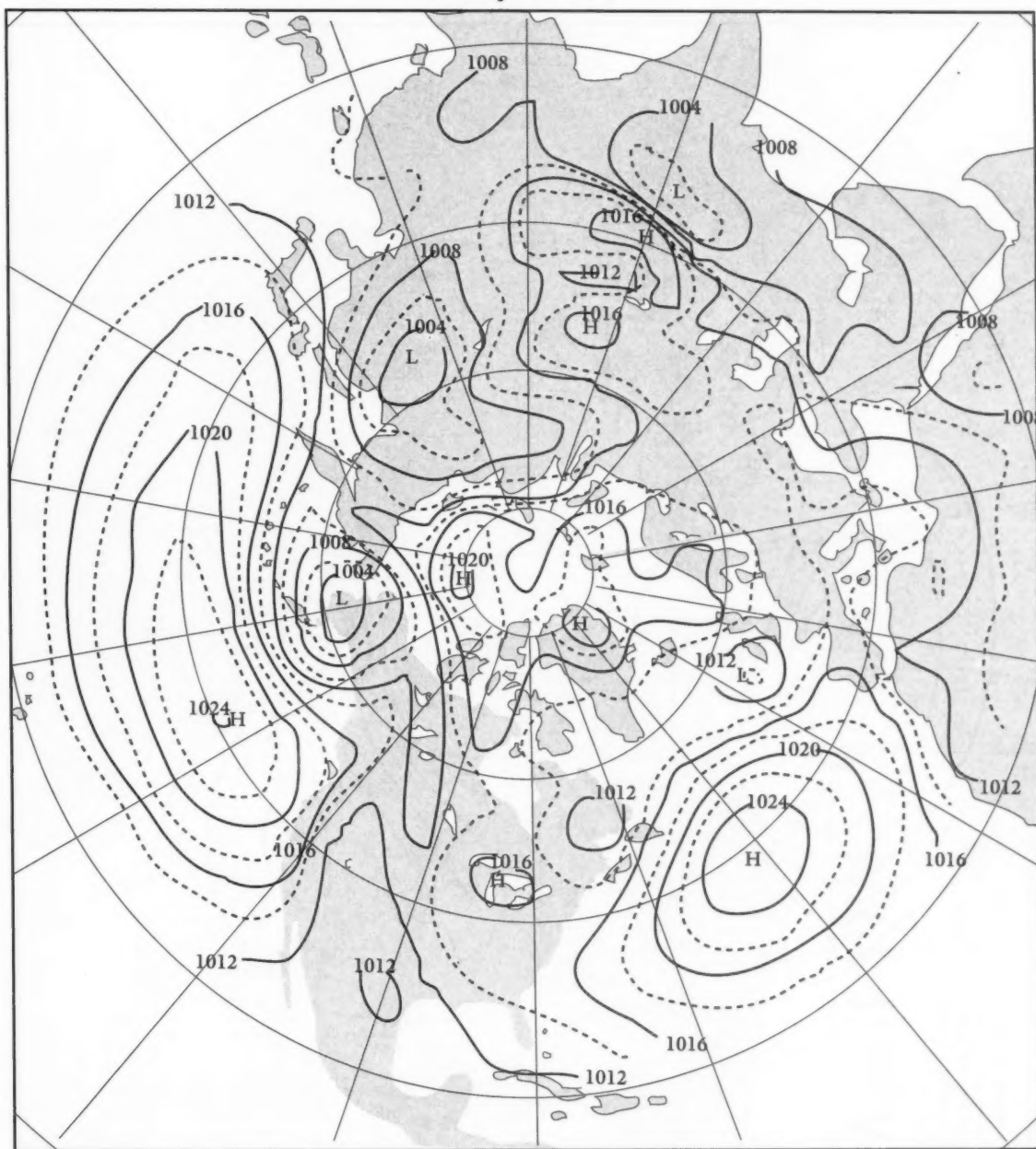
April 1994



These Mean Sea Level Pressure Charts were provided by John Kopman and Vernon Kousky of the Climate Analysis Center from the Climate Diagnostics Bulletin. The pressure is presented in 2 millibar increments where possible and labeled every 4 millibars.



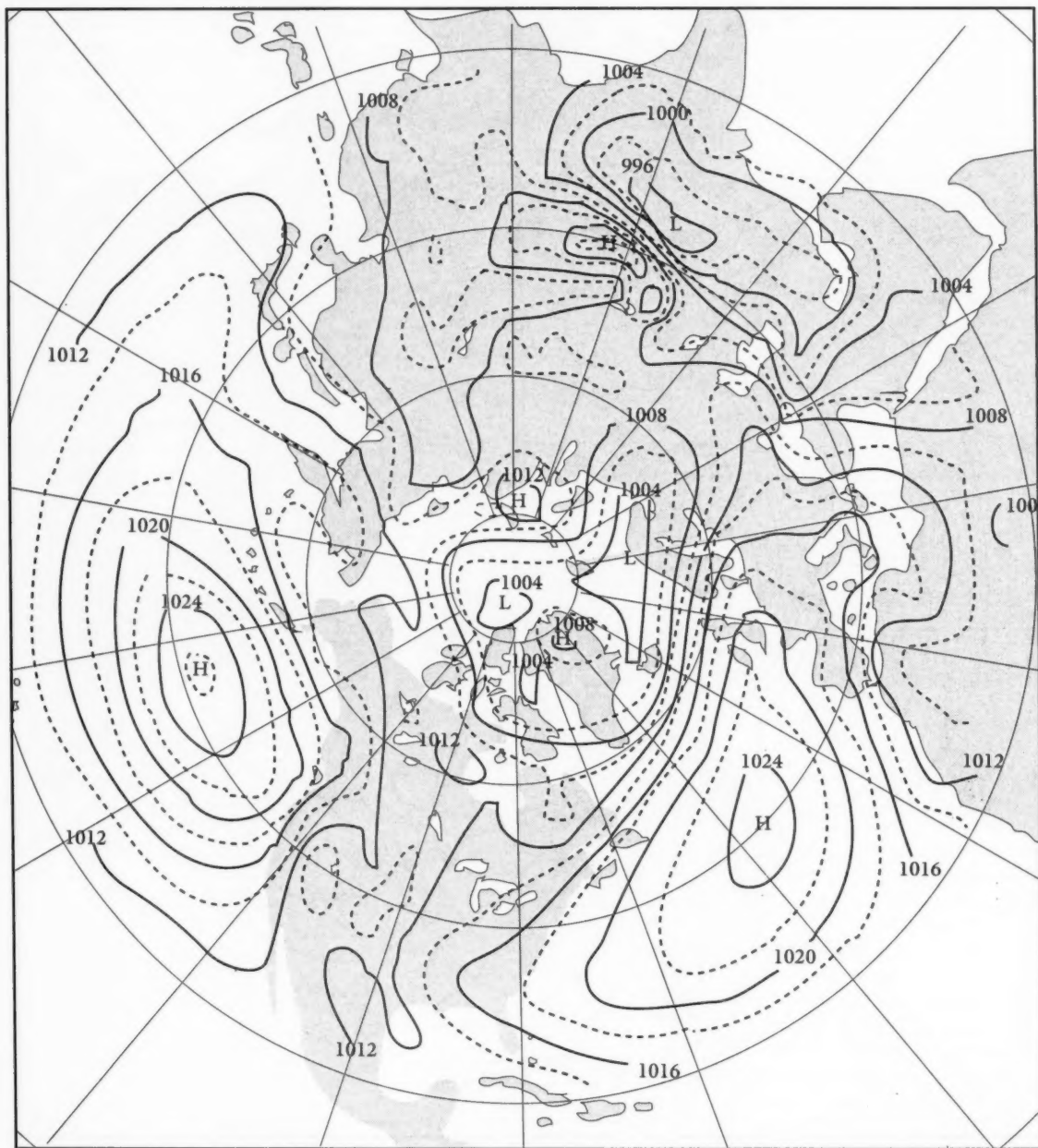
May 1994



These Mean Sea Level Pressure Charts were provided by John Kopman and Vernon Kousky of the Climate Analysis Center from the Climate Diagnostics Bulletin. The pressure is presented in 2 millibar increments where possible and labeled every 4 millibars.

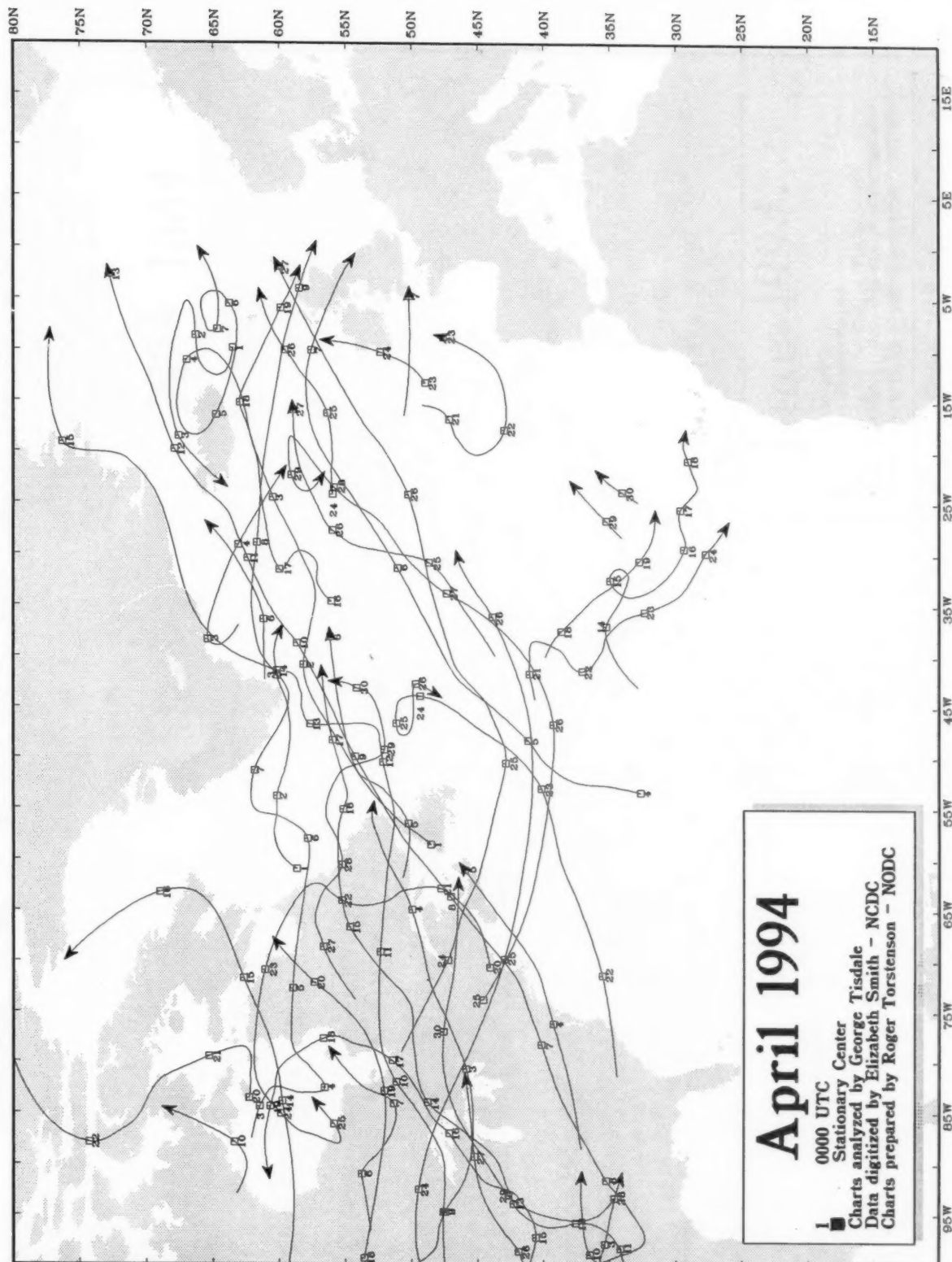


June 1994

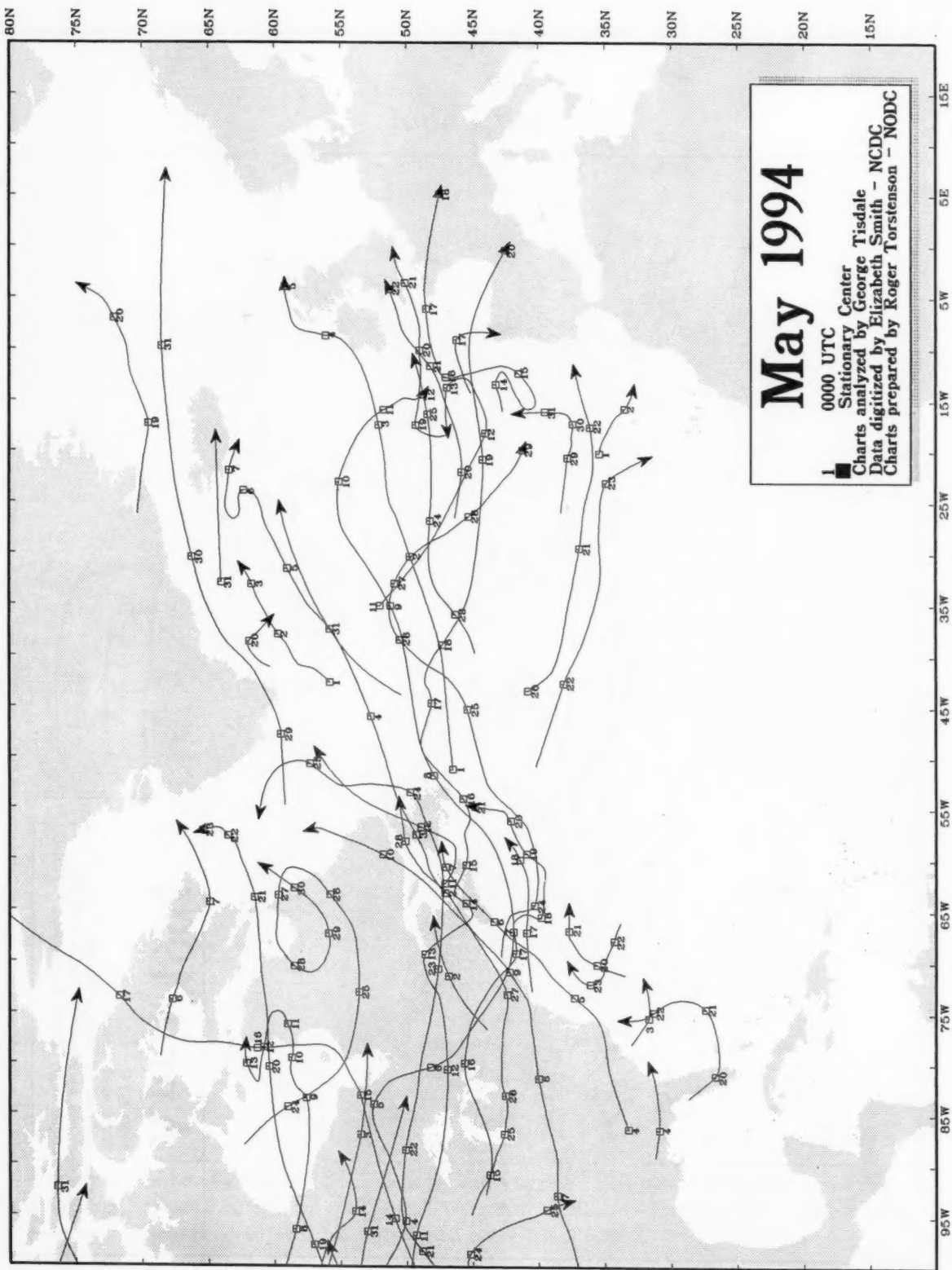


These Mean Sea Level Pressure Charts were provided by John Kopman and Vernon Kousky of the Climate Analysis Center from the Climate Diagnostics Bulletin. The pressure is presented in 2 millibar increments where possible and labeled every 4 millibars.

# Principal Tracks of Cyclone Centers at Sea Level, North Atlantic



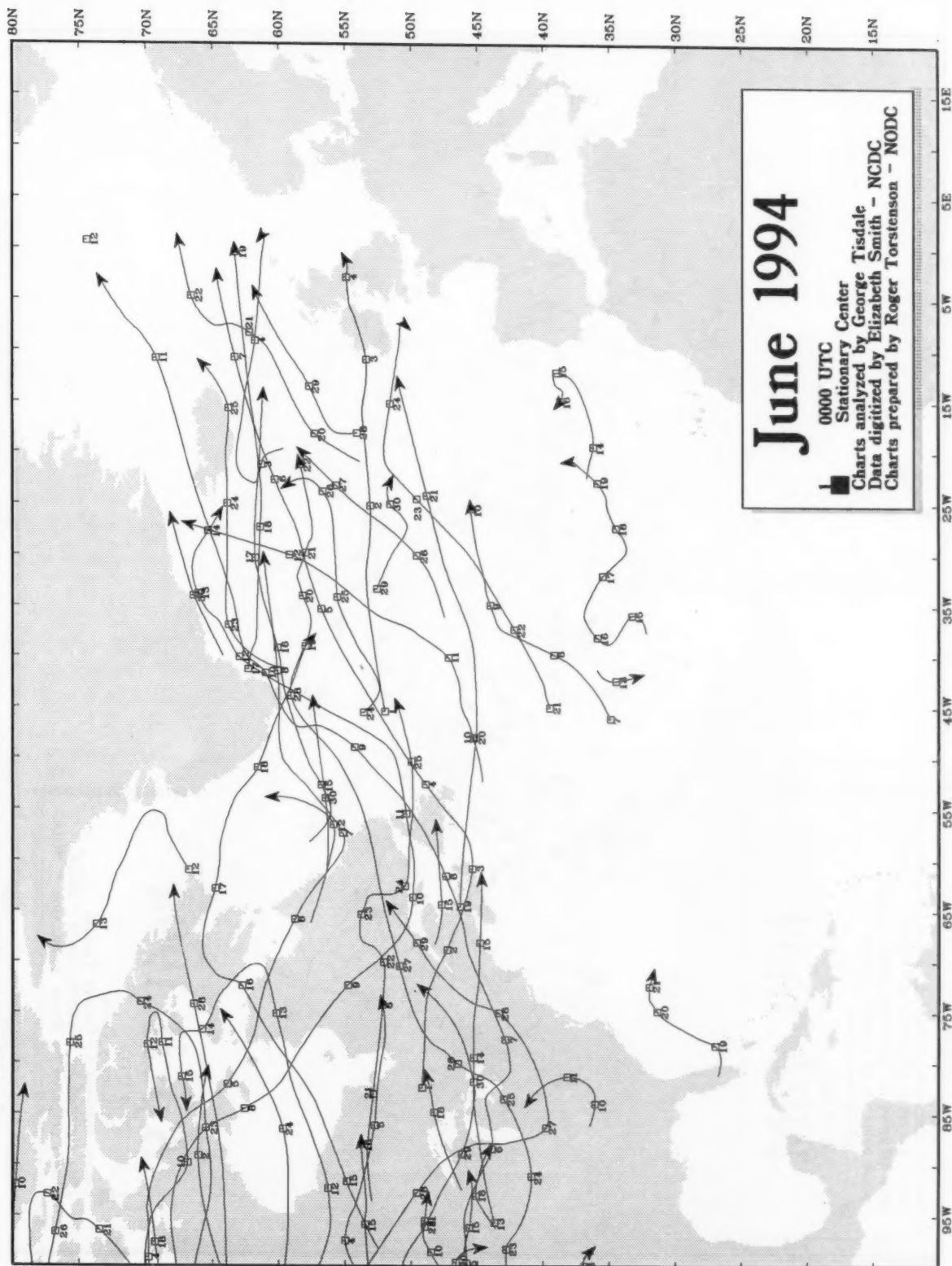
# Principal Tracks of Cyclone Centers at Sea Level, North Atlantic



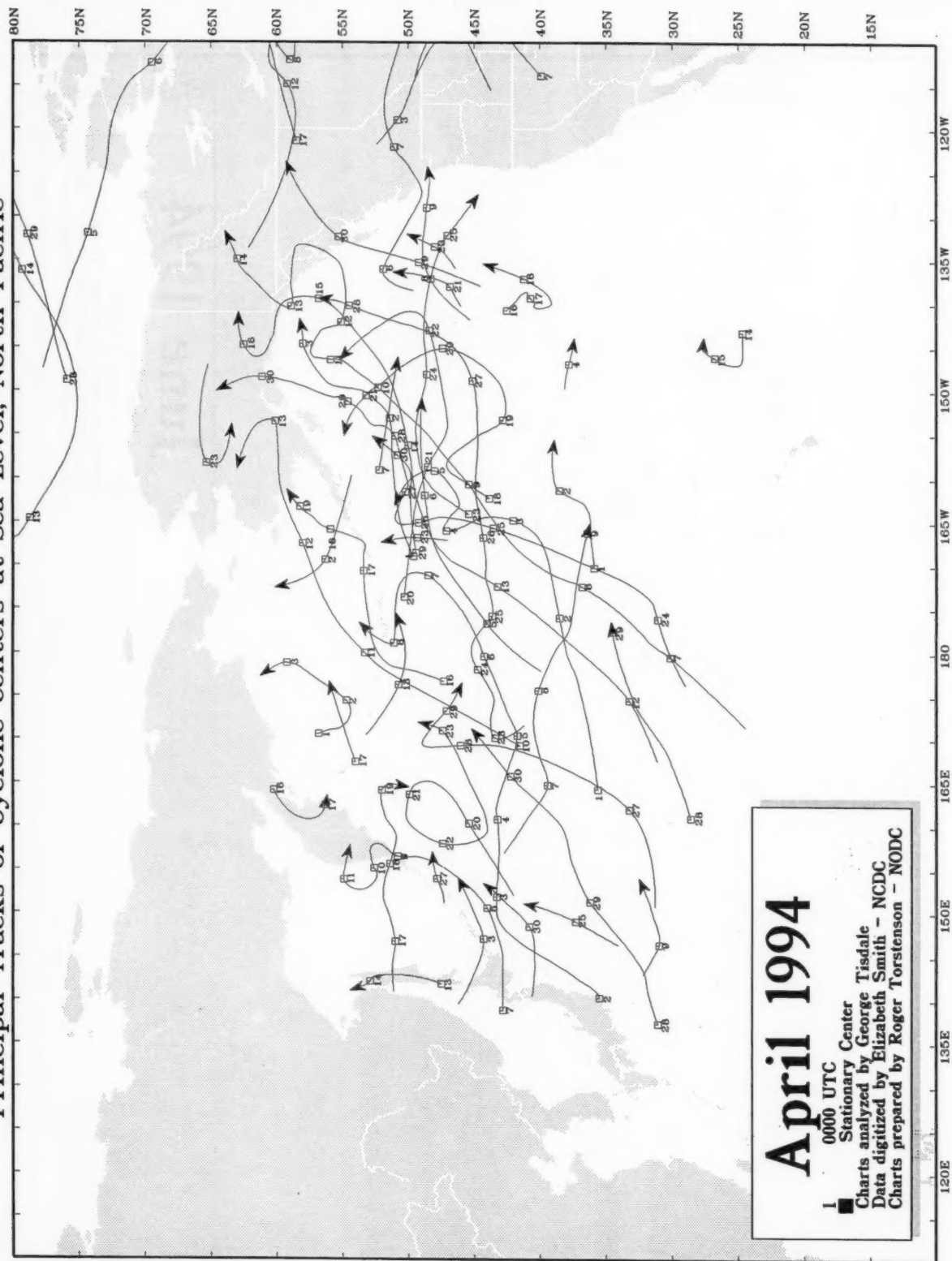
## May 1994

0000 UTC  
 Stationary Center  
 Tisdale  
 Charts analyzed by George  
 Data digitized by Elizabeth Smith - NCDC  
 Charts prepared by Roger Torstenson - NODC

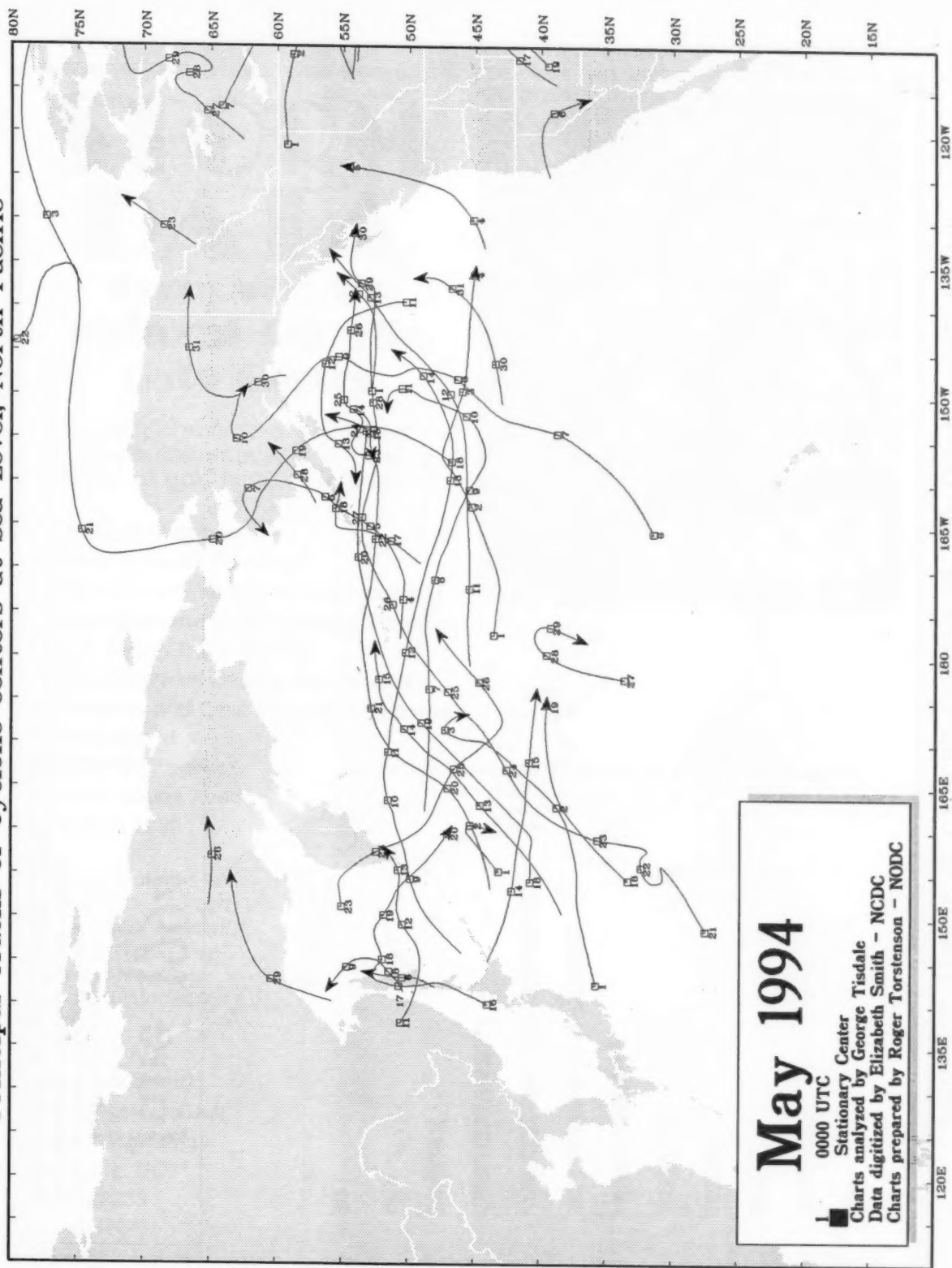
# Principal Tracks of Cyclone Centers at Sea Level, North Atlantic



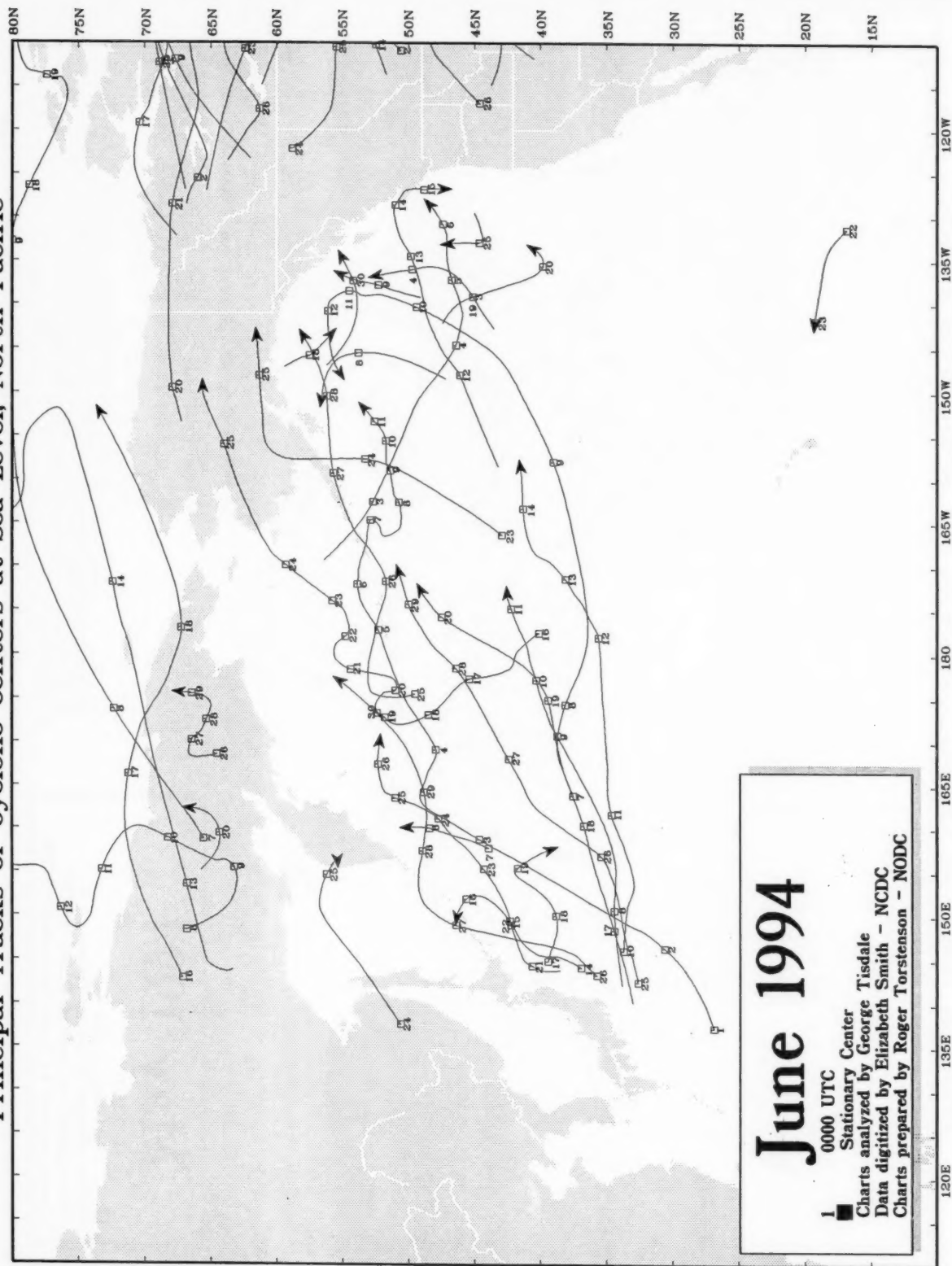
# Principal Tracks of Cyclone Centers at Sea Level, North Pacific



# Principal Tracks of Cyclone Centers at Sea Level, North Pacific



# Principal Tracks of Cyclone Centers at Sea Level, North Pacific



# STORM DATA

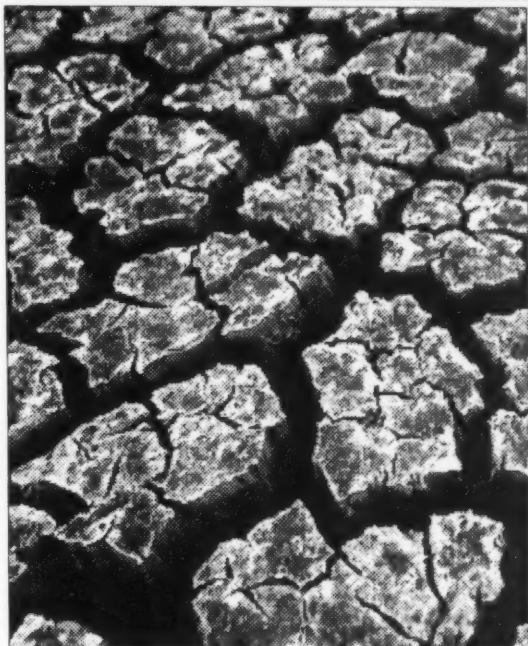
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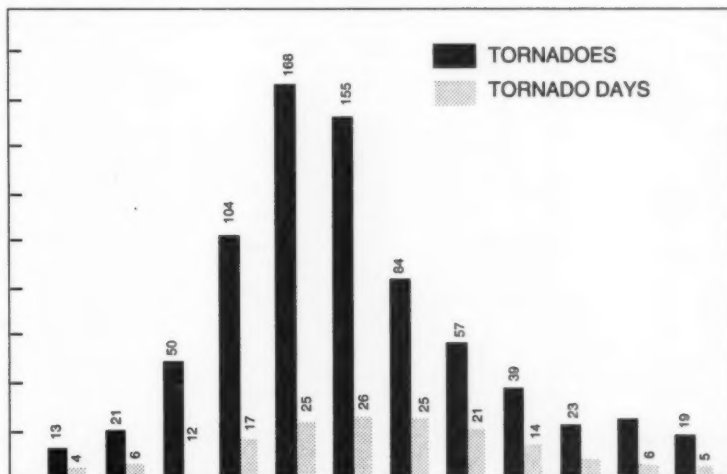
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## AVERAGE NUMBER OF TORNADOES AND TORNADO DAYS EACH MONTH IN THE UNITED STATES

(BASED ON 28,820 TORNADOES THAT OCCURRED FROM 1953-1990)





## March, April, May and June 1994

	RADIO	MAIL		RADIO	MAIL		RADIO	MAIL
1ST LT ALEX BONNYMAN	1		BOVEC	160		COLUMBUS OHIO	23	
1ST LT BALDOMERO LOPEZ	6		BP ADMIRAL	177		COLUMBUS QUEENSLAND	86	
1ST LT JACK LUMMUS	13		BP ADVENTURE	106		COLUMBUS VICTORIA	220	
2ND LT. JOHN P. BOBO	22	4	BRAVERY	30	37	COLUMBUS WELLINGTON	55	
A. V. KASTNER	137		BRAZILIAN REEFER	4		COMPANION EXPRESS	74	
ACADIA FOREST	105	278	BREMEN EXPRESS	116		CONCERT EXPRESS	49	
ACE ACCORD	50	44	BRIDGETON	83	26	CONDOLEEZA RICE	44	196
ACT 7	257		BRIGIT MAERSK	14		CONTINENTAL WING	86	
ACT 1	130		BRISBANE STAR	237		CONTSHIP AUSTRALIA	21	
ADABELLE LYKES	80	187	BROOKLYN BRIDGE	259	178	CONTSHIP ENGLAND	6	
ADAM E. CORNELIUS	1		BROOKS RANGE	19	40	CORAH ANN	92	112
ADRIAN MAERSK	27	66	BRUCE SMART	52	152	CORNUCOPIA	55	72
ADVANTAGE	50	108	BUCKEYE	206	268	CORONADO	6	
AFFINITY	20		BUNGA KESIDANG	54		CORPUS CHRISTI	18	35
AGULHAS	63	93	BURNS HARBOR	344	430	CORWITH CRAMER	29	36
ALASKA		76	C.W. KITTO	132		COURIER	65	64
ALBEMARLE ISLAND	46	92	CALIFORNIA CERES	123		COURTNEY BURTON	140	187
ALBERNI DAWN	223		CALIFORNIA HERMES	91	40	COURTNEY L.	175	227
ALBERT MAERSK	15	44	CALIFORNIA LUNA	101		CPL. LOUIS J. HAUGE JR	25	45
ALDEN W. CLAUSEN	82	125	CALIFORNIA MERCURY	236		CRISTOFORO COLOMBO	54	102
ALLIGATOR AMERICA	91		CALIFORNIA ORION	61	152	CROWN PRINCESS	13	
ALLIGATOR COLUMBUS	70	76	CALIFORNIA PEGASUS	72		CSL ATLAS	148	
ALLIGATOR EXCELLENCE	113		CALIFORNIA STAR	39		CSS HUDSON	104	
ALLIGATOR FORTUNE	50		CALIFORNIA TRITON	116	106	DAN MOORE	4	
ALLIGATOR GLORY	53	93	CALIFORNIA ZEUS	42		DEL MONTE CONSUMER	123	122
ALLIGATOR HOPE	44	214	CANADIAN LIBERTY	46	31	DEL MONTE PACKER	31	14
ALLIGATOR JOY	56	62	CAP PALMAS	53		DEL MONTE TRADER	43	45
ALLIGATOR LIBERTY	194		CAPE HATTERAS	51	88	DELAWARE TRADER	122	92
ALLIGATOR PRIDE	132	258	CAPE HORN	43	22	DELMONTE TRANSPORTER	143	148
ALLIGATOR TRIUMPH	44	47	CAPE MAY	193		DENALI	173	
ALMANIA	8	10	CAPE WASHINGTON	55	65	DIRECT EAGLE	103	
ALPENA	233	74	CAPE WRATH	102		DIRECT FALCON	115	129
ALPHA HELIX	31	60	CARINA	45	128	DIRECT KEA	182	
ALTAMONTE	44	18	CARLA A. HILLS	280	231	DMITRIY OLYANOV	25	
ALVA MAERSK	74	75	CARMEL	28		DOCTOR LYKES	225	129
AMERICA STAR	173		CAROLINA	39	172	DON JORGE	7	
AMERICAN CONCOR	120	199	CARTAGENA	150	43	DOUBLE GLORY	22	
AMERICAN FALCON	125	151	CASON J. CALLAWAY	180	185	DSR BALTIC	192	
AMERICAN KESTREL	16		CATHAY SPIRIT	32		DSR EUROPE	198	
AMERICAN MARINER	21	18	CCNI ANTARTICO	52	29	DUSSELDORF EXPRESS	1295	
AMERICAN VETERAN	17	64	CEDRELA	68		DYVI BALTIC	42	37
AMERICANA	64	51	CELEBRATION	43	50	DYVI OCEANIC	122	
AMERIGO VESPUCCI	58	93	CENTURY HIGHWAY #2	60		E.P. LE QUEBECOIS	572	
ANDERS MAERSK	185	213	CENTURY HIGHWAY NO. 1	81		ECSTASY	23	33
ANNA	66		CENTURY HIGHWAY NO. 5	293		EDELWISS	179	79
ANNA MAERSK	64	212	CENTURY HIGHWAY NO. 3	137		EDGAR B. SPEER	169	193
APJ SHALIN	12		CENTURY LEADER NO. 1	158		EDINBURGH FRUID	11	
ARABIAN SENATOR	89		CGM LORRAINE	33		EDWIN H. GOTT	318	366
ARCO ALASKA		15	CHACABUCO	108	79	EDWIN LINK		90
ARCO ANCHORAGE	38	11	CHARLES ISLAND		55	EDYTH L.	34	106
ARCO CALIFORNIA		80	CHARLES LYKES	95	43	EIBE OLDENDORFF	106	131
ARCO FAIRBANKS	19		CHARLES M. BEGHLEY	23	33	ELENORE	1	79
ARCO INDEPENDENCE	10	17	CHARLES PIGOTT		24	ELIZABETH LYKES	3	10
ARCO JUNEAU	5		CHARLESTON	10	20	ELIZABETH OLDENDORFF	10	19
ARCO SPIRIT	6		CHARLOTTE LYKES	75	157	ELLEN KNUDSEN	63	
ARCO TEXAS	24	20	CHASTINE MAERSK	37	108	ELSBORG	1	54
ARCTIC OCEAN		35	CHC NO.1	28		EMMA OLDENDORFF	137	
ARGONAUT	54	96	CHEMICAL PIONEER	139	44	ENDEAVOR 2	80	
ARIL MAERSK	12	43	CHERRY VALLEY	3		EUROPEAN SENATOR	57	
ARIZONA	47	24	CHESAPEAKE TRADER	99	19	EVER GAINING	5	4
ARMO	100	109	CHESTNUT HILL	39	21	EVER GATHER	1	
ARNOLD MAERSK	50	43	CHEVRON ANTWERP	32	96	EVER GENTLE	6	
ARTHUR M. ANDERSON	169	182	CHEVRON ATLANTIC	24	185	EVER GENTRY	7	24
ARTHUR MAERSK	118	87	CHEVRON CALIFORNIA	108	51	EVER GIANT	24	
ASHLEY LYKES	77	54	CHEVRON COLORADO	63	53	EVER GLAMOUR	35	10
ATIGUN PASS	61	47	CHEVRON EDINBURGH	253	211	EVER GLOBE	2	
ATLANTA BAY	141		CHEVRON EMPLOYEE PRIDE		73	EVER GLORY	11	9
ATLANTIC CARTIER	55		CHEVRON MISSISSIPPI	53	89	EVER GLOWING	79	
ATLANTIC COMPASS	94		CHEVRON PACIFIC	3	63	EVER GOODS	9	
ATLANTIC CONVEYOR	122		CHEVRON WASHINGTON	31	42	EVER GRADE	19	
			CHIQUITA BOCAS	52		EVER GROUP	10	7
ATLANTIC OCEAN	31	62	CHIQUITA CINCINNATIAN	46	108	EVER GUARD	6	
AUSTRAL RAINBOW	13	39	CHIQUITA ITALIA	218		EVER GUIDE	1	
AUTHOR	32		CHIQUITA JEAN	260		EVER LAUREL	23	
AXEL MAERSK	39	171	CHIQUITA SCANDINAVIA	195		EVER LEVEL	18	
B.T. ALASKA	125	236	CIELO DI FIRENZE	58		EVER LIVING	16	
BAAB ULLAH	1		CLEMENTINA	22		EVER LOADING	7	
BALIKESIR	27		CLEVELAND	13	63	EVER ROYAL	95	183
BALTIC SUN	143		CLIFFORD MAERSK	23	33	EXPORT FREEDOM	58	181
BALTIMORE TRADER	109	182	CO-OP EXPRESO	76	60	EXPORT PATRIOT	64	173
BARBARA ANDRIE	34	23	COAST RANGE	44	74	FAIRLIFT	37	
BARRINGTON ISLAND	122		COASTAL EAGLE POINT	9	12	FAIRMAST	223	
BAY BRIDGE	171	221	COLORADO	15		FANTASY	57	63
BEBEDOURO	147	132	COLUMBIA BAY	105		FARALLON ISLAND	297	
BERNARDO QUINTANA A	118	134	COLUMBIA STAR	391	101	FAUST	104	86
BIBI	202		COLUMBUS AMERICA	383		FEDERAL SKEENA	109	146
BLUE RIDGE	105	85	COLUMBUS AUSTRALIA	96		FERNICROFT	126	155
BOGASARI LIMA	159		COLUMBUS CALIFORNIA	250		FESTIVALE	41	70
BONN EXPRESS	181		COLUMBUS CANADA	368	262	FETISH	213	272
BOSPORUS BRIDGE	270	416	COLUMBUS ISELIN	3		FIESTAMARINA	41	51
			COLUMBUS NEW ZEALAND	232		FIR GROVE	70	



## March, April, May and June 1994

	RADIO	MAIL		RADIO	MAIL		RADIO	MAIL
FLEMMING SIF	87	33	INDIAN OCEAN	19	13	MAASDAM	71	101
FOREST HAWK	1		INFANTA	79		MACKINAC BRIDGE	263	42
FRANCES HAMMER	168		INGER	53		MADAME BUTTERFLY	20	
FRANCES L.	89	122	IOWA TRADER	37	71	MADISON MAERSK	67	72
FRED G.	31	22	ISABELLA	17		MAERSK CONSTELLATION	50	60
FRED R. WHITE JR	80	102	ISLAND PRINCESS	86		MAERSK SANTIAGO	46	118
FREDERICKSBURG	83	51	ITB BALTIMORE	67	68	MAERSK SUN	39	
FREJA SVEA	34	23	ITB GROTON	183	213	MAGIC	127	73
FRINES	145		ITB JACKSONVILLE	168	190	MAGLEBY MAERSK	61	134
GALVESTON BAY	349	238	ITB MOBILE	75	20	MAJ STEPHEN W PLESS MP	29	64
GENEVIEVE LYKES	66	107	ITB NEW YORK	78	23	MAJESTIC MAERSK	57	138
GEORGE A. SLOAN	80	88	ITB PHILADELPHIA	21		MANGAL DESAI	29	38
GEORGE A. STINSON	67	78	IVER EXPLORER	3		MANILA SUNRISE	69	134
GEORGE SCHULTZ	38		IVER EXPRESS	10		MANUKAI	106	243
GEORGE WASHINGTON BRID	258	66	J. DENNIS BONNEY		176	MANULANI	66	132
GEORGIA RAINBOW II	69	70	JAHRE SPIRIT	10		MARATHA MAJESTY	113	
GERMAN SENATOR	26		JALAGOPAL	2		MARCHEN MAERSK	72	96
GERONIMO	4		JALISCO	87	37	MAREN MAERSK	35	96
GLOBAL LINK	69	123	JAMES LYKES	65	53	MARGARET LYKES	51	76
GLOBAL SENTINEL	47	21	JAMES N. SULLIVAN	1	70	MARGRETHE MAERSK	63	149
GOLDEN ALPHA	26	162	JAMES R. BARKER	116	133	MARIA TOPIC	81	138
GOLDEN APO	18	9	JAPAN RAINBOW 2	77	81	MARIE MAERSK	26	60
GOLDEN BEAR	40		JAPAN SENATOR	91		MARIF	9	28
GOLDEN GATE	31	74	JASMINE	289		MARINE PRINCESS	179	
GOLDEN GATE BRIDGE	253	127	JEAN LYKES	96	144	MARINE RELIANCE	32	52
GOPHER STATE	37	73	JEBEL ALI	19		MARIT MAERSK	67	86
GREAT LAND	160	265	JEREMIAH O'BRIEN	23	52	MARJORIE LYKES	67	86
GREEN BAY	47		JOHN G. MUNSON	101	116	MARLIN	11	151
GREEN CEDAR	21	69	JOHN J. BOLAND	125	123	MATHILDE MAERSK	183	233
GREEN HARBOR	31	42	JOHN LYKES	65		MATSONIA	240	242
GREEN ISLAND	44	69	JOHN YOUNG		178	MAUI	145	
GREEN LAKE	103	61	JOSEPH H. FRANTZ	242	286	MAURICE EWING	2	
GREEN MAYA	56		JOSEPH L. BLOCK	112	151	MAYA	150	76
GREEN RIDGE	68	175	JUBILANT	22	24	MAYAGUEZ	48	127
GREEN SASEBO	64	48	JULIUS HAMMER	226		MAYVIEW MAERSK	88	154
GREEN SUMA	28	42	KAHO		19	MC-KINNEY MAERSK	171	44
GREEN SYLVAN	54		KAIMOKU	202	187	MEDALLION	234	280
GREEN VALLEY	72	98	KAINALU	180	144	MEDUSA CHALLENGER	198	
GREEN WAVE	62	51	KAKUSHIMA	57	114	MELBOURNE STAR	291	334
GROWTH RING	182		KANSAS TRADER	96		MELVILLE	42	27
GUAYAMA	51	76	KAREN ANDRIE	40	42	MERCANDIAN CONTINENT	4	
GYPSUM BARON	201		KAUAI	108	68	MERCHANT PRELUDE	165	
GYPSUM KING	147		KAYE E. BARKER	191	236	MERCHANT PREMIER	32	
H. LEE WHITE	59	86	KEE LUNG	39	29	MERCHANT PRINCE	140	
HAKONE MARU	2		KEISHO MARU	73		MERCHANT PRINCIPAL	120	
HANJIN BREMEN	11		KELVIN CHALLENGE	34		MERIDA	143	186
HANJIN CHUNGMU	89		KENAI	178	146	MESABI MINER	61	92
HANJIN ELIZABETH	8		KENNETH E. HILL	44	58	METTE MAERSK	240	314
HANJIN FELIXTOWE	16		KENNETH T. DERR	71	24	MICHIGAN	84	
HANJIN HAMBURG	16		KENTUCKY HIGHWAY	65		MICHIGAN HIGHWAY	4	
HANJIN KOBE	55	16	KEYSTONE CANYON	45	68	MICRONESIAN INDEPENDEN	149	
HANJIN LE HAVRE	13		KINSMAN ENTERPRISE	4	27	MICRONESIAN PRIDE	92	115
HANJIN LONG BEACH	8		KNORR	63		MIDDLETOWN	46	
HANJIN MARSEILLES	40	23	KOLN EXPRESS	955		MINERVA	184	
HANJIN MASAN	55		KOPER EXPRESS	22		MING PLEASURE	48	64
HANJIN NEW YORK	50		KURE	30	33	MING PLINY	4	
HANJIN OAKLAND	10	19	LA TRINITY	82	102	MITLA	168	61
HANJIN ROTTERDAM	24	3	LADY MARYLAND	61		MOANA PACIFIC	8	
HANJIN SAVANNAH	56	16	LAKE GUARDIAN	58	68	MOANA WAVE	126	201
HANJIN SEATTLE	13		LASH ATLANTIC	12		MOKU PAHU	131	
HANJIN TONGHAE	50		LAWRENCE H. GIANELLA	33	32	MONTERREY	119	59
HANJIN VANCOUVER	16		LEONARD J. COWLEY	101		MORLOS	12	
HANJIN YOKOHAMA	49		LEONIA	144		MORMACSKY	96	22
HANSA LUBECK	170		LERMA	141		MORMACSTAR	71	102
HANSA VISBY	54		LESLIE LYKES	127	73	MORMACSUN	11	
HEIDELBERG EXPRESS	117		LETITIA LYKES	44	39	MOSTWEE 7	73	
HENRY HUDSON BRIDGE	221		LIBERTY BELLE	6		MT. CABRITE	127	116
HERBERT C. JACKSON	36	51	LIBERTY SPIRIT	7	7	MYRON C. TAYLOR	95	118
HEREFORDSHIRE	31		LIBERTY STAR	31	22	NACIONAL VITORIA	71	44
HERMOS	184		LIBERTY SUN	37	63	NARA	37	
HESIOD	64		LIBERTY VICTORY	45	11	NATAL	39	51
HETTSTEDT	44		LIBERTY WAVE	194	159	NATIONAL DIGNITY	48	74
HIBISCUS	40		LIRCAY	9	40	NATIONAL HONOR	38	105
HOEGH CAIRN	21		LNG AQUARIUS	5		NATIONAL PRIDE	105	129
HOEGH CLIPPER	30		LNG CAPRICORN	48	101	NEDLLOYD HOLLAND	180	
HOEGH DRAKE	13		LNG LEO	29	79	NEDLLOYD ROTTERDAM	110	
HOEGH DUKE	25		LNG TAURUS	47	142	NEDLLOYD VAN CLOON	59	
HOEGH DYKE	7	40	LNG VIRGO	65		NEDLLOYD VAN DIEMEN	119	
HOEGH MERCHANT	1		LOA	331		NEDLLOYD VAN LINSCHOTE	248	
HOEGH MINERVA	74	56	LONDON ENTERPRISE	79		NEDLLOYD VAN NECK	151	
HOLIDAY	54	109	LONDON SPIRIT	58		NEDLLOYD VAN NOORT	14	
HOOD ISLAND	44	70	LONGAVI	3	126	NEPTUNE ACE	48	53
HOWELL LYKES	39	29	LOUISE LYKES	18		NEPTUNE AMBER	33	
HUAL ANGELITA	19		LOUISIANA	45		NEPTUNE AZURITE	96	
HUAL INGRITA	95	116	LT ARGOSY	33		NEPTUNE CORAL	74	
HUAL ROLITA	39		LT PRAGATI	56	165	NEPTUNE CRYSTAL	75	
HUMACAO	89		LT ODYSSEY	94	237	NEPTUNE DIAMOND	25	
HYUNDAI CONTINENTAL	32		LUCKY BULKER			NEPTUNE GARNET		
HYUNDAI DUKE	9		LUCY OLDENDORFF			NEPTUNE JADE		
HYUNDAI VANCOUVER			LUNA MAERSK			NEPTUNE PEARL		
INDIAN GOODWILL			LURLINE			NEVA		67



## March, April, May and June 1994

	RADIO	MAIL		RADIO	MAIL		RADIO	MAIL
NEW CARISSA	81	339	PAUL BUCK	54	24	SANTA MONICA	86	
NEW HORIZON	13		PAUL H. TOWNSEND	140	174	SANTA PAULA	117	159
NEW YORK SENATOR	19		PAUL R. TREGURTHA	272	318	SANTORIN 2	60	432
NEWARK BAY	83	107	PAUL THAYER	15	40	SAPAI	3	
NIEUW AMSTERDAM	28		PEMBINA	25		SAUDI QASSIM	46	
NIPPON HIGHWAY	15		PETROBULK PROGRESS	66		SAVANNAH	14	
NOAA DAVID STARR JORDA	206	40	PFC DEWAYNE T. WILLIAM	7		SCARAB	41	
NOAA SHIP ADVENTUROUS		71	PFC EUGENE A. OBREGON	39	8	SEA BELLS	44	180
NOAA SHIP ALBATROSS IV	345	388	PFC JAMES ANDERSON JR	12	20	SEA COMMERCE	163	313
NOAA SHIP CHAPMAN	389	427	PFC WILLIAM B. BAUGH	35	10	SEA FAN	44	136
NOAA SHIP DELAWARE II	494	569	PHAROS	51		SEA FORTUNE	67	220
NOAA SHIP DISCOVERER O	687	758	PHILIP R. CLARKE	74	77	SEA FOX	132	85
NOAA SHIP FERREL	102		PHOENIX DIAMOND	24		SEA ISLE CITY	41	109
NOAA SHIP M. BALDRIDGE	540	355	PISCES PLANTER	153		SEA LIGHT	36	26
NOAA SHIP MCARTHUR	32	222	PLATTE	34	69	SEA LION	368	86
NOAA SHIP MILLER FREEM	79	682	POLYNESIA	221	68	SEA SPRAY	3	
NOAA SHIP MT MITCHELL	285	414	POTOMAC	15		SEA TRADE	86	
NOAA SHIP OREGON II	358	350	POTOMAC TRADER	12		SEA WOLF	238	180
NOAA SHIP RAINIER	80	180	PRESIDENT ADAMS	126	161	SEA-LAND SHINING STAR	161	175
NOAA SHIP SURVEYOR	179	244	PRESIDENT ARTHUR	83	163	SEABOARD OCEAN	315	323
NOAA SHIP T. CROMWELL	16	285	PRESIDENT BUCHANAN	19	84	SEABOARD SUN	61	57
NOAA SHIP WHITING	371	434	PRESIDENT EISENHOWER	142	153	SEACON	124	450
NOBEL STAR	138	79	PRESIDENT F. ROOSEVELT	188	181	SEALAND ANCHORAGE	78	201
MORD JAHRE TARGET	182	74	PRESIDENT GARFIELD	67		SEALAND ATLANTIC	141	135
NORTHERN LIGHTS	268	302	PRESIDENT GRANT	79	145	SEALAND CHALLENGER	92	130
NORWAY	88	47	PRESIDENT HARDING	125	23	SEALAND CONSUMER	181	151
NOSAC CEDAR	6		PRESIDENT HARRISON	126		SEALAND COSTA RICA	143	165
NOSAC EXPLORER	5		PRESIDENT HOOVER	35	139	SEALAND CRUSADER	110	23
NOSAC EXPRESS	18		PRESIDENT JACKSON	109	169	SEALAND DEFENDER	130	48
NOSAC RANGER	114	176	PRESIDENT JEFFERSON	94	231	SEALAND DEVELOPER	60	125
NOSAC STAR	22		PRESIDENT KENNEDY	127	126	SEALAND DISCOVERY	75	34
NOSAC TAKAYAMA	91	173	PRESIDENT LINCOLN	80	219	SEALAND ENDURANCE	120	207
NUEVO LEON	38	49	PRESIDENT MONROE	184	161	SEALAND ENTERPRISE	272	285
NUEVO SAN JUAN		15	PRESIDENT POLK	173	248	SEALAND EXPEDITION	42	74
NURNBERG ATLANTIC	415		PRESIDENT TRUMAN	19	197	SEALAND EXPLORER	89	24
NYK SEABREEZE	74		PRESIDENT TYLER	88	224	SEALAND EXPRESS	197	267
NYK SPRINGTIDE	236		PRESIDENT WASHINGTON	148	171	SEALAND HAWAII	269	232
NYK STARLIGHT	76		PRESQUE ISLE	95	128	SEALAND INDEPENDENCE	76	65
NYK SURFVIND	34		PRIDE OF BALTIMORE	145	123	SEALAND INNOVATOR	143	102
OAXACA	214	95	PRINCE OF OCEAN	101		SEALAND INTEGRITY	350	313
OBO ENGIN	30		PRINCE OF TOKYO	146	207	SEALAND KODIAK	8	6
OCEAN EXPLORER	220		PRINCE OF TOKYO 2	143	118	SEALAND LIBERATOR	102	98
OCEAN HIGHWAY	65		PRINCE WILLIAM SOUND	17	72	SEALAND MARINER	96	205
OCEAN LEADER	47		PROOF GALLANT		84	SEALAND NAVIGATOR	245	190
OCEAN OPAL	74	131	PUEBLA	82		SEALAND PACIFIC	218	140
OCEAN SPIRIT	421		PUERTO CORTES	36		SEALAND PATRIOT	80	148
OCEAN VICTOR	34	3	PVT FRANKLIN J. PHILLI	10	30	SEALAND PERFORMANCE	49	188
OELIA	30	29	PYTCHELY	316		SEALAND PRODUCER	67	152
OLIVE ACE	20		QUALITY OF LIFE	9		SEALAND QUALITY	73	87
OMI MISSOURI	73	127	QUEEN ELIZABETH 2	181		SEALAND RELIANCE	99	82
OOCAL BRAVERY	52		QUEENSLAND STAR	213		SEALAND SPIRIT	94	194
OOCAL EDUCATOR	110	65	R. HAL DEAN	15		SEALAND TACOMA	51	88
OOCAL ENVOY	107		R.J. PFEIFFER	165	115	SEALAND TRADER	164	151
OOCAL EXECUTIVE	124	103	RAINBOW WARRIOR	24		SEALAND VALUE	81	166
OOCAL EXPLORER	72	63	RALEIGH BAY	118	96	SEALAND VOYAGER	106	99
OOCAL EXPORTER	134		RANGER	1		SEARIVER BATON ROUGE	29	26
OOCAL FAIR	133	45	RANI PADMINI	64		SEARIVER BENICIA	43	13
OOCAL FAITH	87		RECIFE	188	7	SEARIVER CHARLESTOWN		2
OOCAL FAME	81	14	REGAL EMPRESS	9		SEARIVER LONG BEACH	20	27
OOCAL FIDELITY	165		REPULSE BAY	144		SEARIVER MEDITERRANEAN	29	29
OOCAL FORTUNE	119	104	RESERVE	56	66	SEARIVER NORTH SLOPE	32	10
OOCAL FREEDOM	224		RESOLUTE	75	196	SEARIVER PHILADELPHIA	16	13
OOCAL FRIENDSHIP	105		RHINE FOREST	134	250	SEARIVER SAN FRANCISCO	1	
OOCAL INNOVATION	69	89	RICHARD G MATTIESEN	69	44	SEDCO BP 471	242	420
OOCAL INSPIRATION	40	84	RICHARD REISS	39	28	SENATOR	151	
ORANGE BLOSSOM	94	115	RISANGER	9		SENSATION	12	91
ORANGE WAVE		106	RIVERHEAD SPIRIT	14	5	SEVEN OCEAN	47	47
ORION HIGHWAY	178	178	ROBERT E. LEE	36	63	SGT WILLIAM A BUTTON	3	23
OURO DO BRASIL	111	40	ROGER BLOUGH	126	167	SGT. METEJ KOCAK	31	43
OVERSEAS ALASKA	110	160	ROTTERDAM	75		SHELDON LYKES	68	175
OVERSEAS ARCTIC	46		ROVER	23		SHELLY BAY	94	121
OVERSEAS HARRIET	47	6	ROWANBANK	107		SHIRAOI MARU	197	57
OVERSEAS JOYCE	58	122	ROYAL PRINCESS	86		SIDNEY STAR	279	
OVERSEAS JUNEAU	22	107	RUBIN DOGA	33	13	SIERRA MADRE	18	
OVERSEAS NEW ORLEANS	56	35	RUBIN OCEAN	27	23	SINBAD	16	28
OVERSEAS OMO	39	100	RUTH LYKES	27	165	SINCERE SUCCESS	29	
OVERSEAS PHILADELPHIA		23	S.T. CRAPO	143	121	SKANDERBORG	9	35
PACASIA	27	15	SALINA CRUZ PILOTS	1		SKAUBRYN	126	
PACIFIC EMERALD	29	25	SALINAS	4		SKAUGRAN	185	123
PACKING	20		SALOME	75	76	SKODSBORG		47
PACMERCHANT	59		SAM HOUSTON	27	27	SKOGAFOSS	132	
PACOCLEAN	20		SAMUAL GINN	3		SN	428	
PACPRINCE	54	18	SAMUEL H. ARMACOST	81	126	SOKOLICA	26	
PACPRINCESS	38		SAMUEL L. COBB	50	16	SOLAR WING	144	192
PACQUEEN	16		SAMUEL L. RILEY	779		SOREN TOUBRO	15	
PACSTAR	32		SAN LORENZO	56		SOUTHERN PRINCESS		201
PAPAGO	107	135	SAN MARCOS	306	17	ST BLAIZE	103	
PARIS SENATOR	31		SAN PEDRO	66		ST. LUCIA	171	
PATRIOT	23	41	SAN VINCENTE	61		STAFFORDSHIRE	125	
PATRIOT STATE	14		SANTA MARTA	4		STAR ALABAMA	53	45



## March, April, May and June 1994

	RADIO	MAIL		RADIO	MAIL		RADIO	MAIL
STAR AMERICA	89	135	USCGC EAGLE (WIX 327)	46		WILLIAM E. CRAIN		
STAR DRIVANGER	60		USCGC FIREBUSH WLB 393	12		WILLIAM E. MUSSMAN	32	155
STAR DROTTANGER	186		USCGC FORWARD	85		WOLVERINE	14	10
STAR EAGLE	119	22	USCGC GALLATIN	7		YOHFU		1
STAR EVVIVA	110	57	USCGC HAMILTON WHEC 71	6		YOUNG SATO	45	15
STAR FLORIDA	140	127	USCGC HARRIET LANE	61		YOUNG SPROUT	105	61
STAR FRASER	73		USCGC IRONWOOD (WLB 29)	21		ZAGREB EXPRESS	9	
STAR FUJI	91		USCGC JARVIS (WHEC 725)	125		ZETLAND	189	
STAR GEIRANGER	9		USCGC LEGARE	75		ZIM AMERICA	105	
STAR GRAN	63	37	USCGC MACKINAW	45		ZIM CANADA	111	
STAR SKARVEN	16	35	USCGC MALLOW (WLB 396)	10		ZIM HOUSTON	21	
STAR SKOGANGER	35	95	USCGC MARIPOSA	39		ZIM IBERIA	94	
STAR STRONEN	3		USCGC MELLON (WHEC 717)	98	129	ZIM KEELUNG	99	
STAR WILMINGTON	3		USCGC MIDGETT (WHEC 72)	102		ZIM MIAMI	87	
STARSHIP MAJESTIC	14	37	USCGC MOHAWK WMEC 913	4		ZIM SAVANNAH	77	
STATE OF MAINE	86	123	USCGC MORGENTHAU	2		ZIM TOKYO	1	
STELLA LYKES	35	46	USCGC MUNRO	148				
STELLAR BENY	106	80	USCGC NORTHLAND WMEC 9	151	110			
STELLAR VENUS	47		USCGC POLAR SEA (WAGB)	199				
STENA TRANSFER	159	160	USCGC RELIANCE WMEC 61	94				
STEWART J. CORT	240	282	USCGC RUSH	43				
STOLT CONOR	14	5	USCGC SASSAFRAS	47				
STONEWALL JACKSON	21		USCGC SEDGE (WLB 402)	15				
STRONG VIRGINIAN	45	119	USCGC SENECA	17				
SUE LYKES	31	24	USCGC SHERMAN		19			
SUGAR ISLANDER	57		USCGC SPENCER	38	83			
SUNBELT DIXIE	97	104	USCGC STEADFAST (WMEC)	39	12			
SUNRISE RUBY	62	60	USCGC STORIS (WMEC 38)	59				
SWIFTNES	118		USCGC SUNDEW (WLB 404)	18				
SYNNOVE KNUSTEN	85	44	USCGC SWEETBRIER WLB 4	21				
T.S. EMPIRE STATE	143		USCGC TAHOMA	16				
TAI CHUNG	80		USCGC TAMPA WMEC 902	23	16			
TAI HE	220		USCGC THETIS		37			
TAI SHING	82	113	USCGC VIGILANT WMEC 61	8				
TAMAMONTA	218		USCGC VIGOROUS WMEC 62	21				
TAMPA	56	71	USCGC WOODRUSH (WLB 40)	29				
TAMPA BAY	57	15	USCGC YOCONA (WMEC 168)	39				
TEXAS CLIPPER	21		USNS ALGOL	3				
TEXAS TRADER	56		USNS ALTAIR	4	8			
THOMAS G. THOMPSON	48	52	USNS ANTARES	59	18			
THOMPSON LYKES	101	199	USNS APACHE (T-ATF 172)	49	5			
THOMPSON PASS	1	54	USNS CATANBA T-ATF 168	213				
TILLIE LYKES	56		USNS DENEbola	59	70			
TOHZAN	23	17	USNS GUADALUPE	15				
TOKYO HIGHWAY	55		USNS GUS W. DARNELL	33	42			
TOLUCA	128	67	USNS HAYES	13				
TONSINA	55	23	USNS JOHN McDONNELL (T)	206	239			
TORM FREYA	85	38	USNS LEROY GRUMMAN		146			
TOWER BRIDGE	75		USNS LITTLEHALES (T-AG)	219	319			
TRANSWORLD BRIDGE	198	121	USNS LOYAL	1				
TRICORD SUCCESS	1		USNS MOHAWK (T-ATF 170)		63			
TRITON	83	136	USNS NARRAGANSETT	129				
TROPIC FLYER	141		USNS NAVAJO (TATF-169)	33				
TROPIC ISLE		48	USNS PECOS	41	24			
TROPIC JADE	62	126	USNS POWHATAN TATF 166	55	58			
TROPIC KEY	6		USNS REGULUS	50				
TROPIC LURE		94	USNS SAN DIEGO	14				
TROPIC MIST		106	USNS SEALIFT ARABIAN S	64				
TROPIC NIGHT		21	USNS SEALIFT ARCTIC	143	106			
TROPIC OPAL		21	USNS SEALIFT ATLANTIC	164	220			
TROPIC PALM		61	USNS SEALIFT CARIBBEAN	171	78			
TROPIC SUN	282	333	USNS SEALIFT CHINA SEA	107	18			
TROPIC TIDE	51	119	USNS SEALIFT INDIAN OC	35				
TROPICALE	12	12	USNS SEALIFT MEDITERRA	100				
TRUSKAVETS	65		USNS SEALIFT PACIFIC		56			
TSL BOLD		154	USNS SILAS BENT T-AGS	79				
TULSIDAS	80		USNS SIOUX	14				
TYSON LYKES	44	87	USNS VANGUARD TAG 194	102				
UCHOA	65	152	USNS WALTER S. DIEHL	1	158			
ULAN BATOR	47		USNS WILKES T-AGS-33	158	82			
ULLSWATER	227		VEGA	164				
ULTRAMAX	18	13	VENUS DIAMOND	86				
ULTRASEA		87	VERA ACORDE	24				
UNIVERSE	34		VINE	242				
USCGC ACACIA (WLB406)	28		VIRGINIA	69	354			
USCGC ACTIVE WMEC 618	45		VISHVA SHAKTI	3				
USCGC ACUSHNET WMEC 16	130		VISHVA VIKRAM	1				
USCGC BASSWOOD (WLB 38)	32		VIVA	45				
USCGC BEAR (WMEC 901)	113		VOROSMARTY		38			
USCGC BISCAYNE BAY	2		WALTER J. MCCARTHY	37	46			
USCGC BOUTWELL WHEC 71	141		WASHINGTON HIGHWAY	175				
USCGC BRAMBLE (WLB 392)	14		WEST MOOR	270				
USCGC CAMPBELL	50		WESTERDAM	58	78			
USCGC CHASE (WHEC 718)	141		WESTERN GALLANTRY	75				
USCGC CONFIDENCE WMEC 6	102	41	WESTWARD		40			
USCGC COURAGEOUS	16	27	WESTWARD VENTURE	128	155			
USCGC CUTTYHUNK	1		WESTWOOD ANETTE	132	216			
USCGC DALLAS (WHEC 716)	1		WESTWOOD BELINDA	39	22			
USCGC DECISIVE WMEC 62	27		WESTWOOD CLEO	61	39			
USCGC DEFENDABLE	113		WESTWOOD MARIANNE	53	103			
USCGC DURABLE (WMEC 62)	46		WILFRED SYKES	57	82			

SUMMARY: GRAND TOTAL VIA RADIO 85529

GRAND TOTAL VIA MAIL 61073

TOTAL UNIQUE OBS 113733

TOTAL DUPLICATES 32869 ( 28.9%)

UNIQUE RADIO OBS.52660 ( 46.3%)

UNIQUE MAIL OBS. 28204 ( 24.8%)



## April, May and June 1994

CALL SIGN	TOTAL	BATHY	TESAC	SHIPNAME
BOAB	63 63	0	TAI HE	
CBVM	21 21		VINADEL MAR	
CGBS	125 0	125	***	
CG2965	13 13		W.E. RICKER	
CGDG	83 0	83	***	
CGDV	46 0	46	***	
CG2676	113 19	94	***	
CG2683	224 0	224	***	
CG2958	178 0	178	***	
C6HQ8	36 36	0	MERCHANT PRINCE	
C6JY6	113 113	0	MELBOURNE STAR	
C6JZ2	62 62	0	AMERICA STAR	
C6MJ4	41 41	0	**	
CZDO	2 2	0		
C6HQ8	1 1	0		
DAKE	216 216	0		
DBKV	53 53	0		
DD8436	95 95	0	FEHMARNBELT	
DGLM	150 150	0	MONTE ROSA	
DHCM	131 131	0	COLUMBUS CALIFORNIA	
DHCW	13 13	0	COLUMBUS WELLINGTON	
DIDA	45 45	0		
D5ND	31 31	0		
D5B6	4 4	0		
D5NE	27 7	0	MT CABRITE	
D5NZ	2 2	0	POLYNESIA	
ELAX2	32 32	0	MICRONESIAN PRIDE	
ELDM8	48 48	0	SEA ISLAND	
ELIS8	74 74	0	T A MARINER	
ELOF6	9 9	0	LONGAVI	
ELQN3	77 77	0	***	
FNDH	19 19	0	***	
FNDK	44 44	0	PATRICIA DELMAS	
FNJT	32 32	0	KORRIGAN	
FNOM	49 49	0	***	
FNPA	53 53	0	RON SARD	
FNQM	39 39	0	SUZANNE DELMAS	
FNWC	32 32	0	NATHALIE DELMAS	
FNXN	17 17	0	SAINT ROMAIN	
FNZP	50 50	0	RACINE	
FNZQ	35 35	0	RIMBAUD	
GACA	150 150	0	CUMULUS	
GXRH	1 1	0		
GYRW	60 60	0		
GYS A	1 1	0		
GTHZ	18 18	0		
JCOD	25 25	0		
GYSE	26 26	0	NEDLLOYD TASMAN	
HPEW	163 163	0	PACIFIC ISLANDER	
JBOA	66 66	0	KEIFU MARU	
JCCX	99 99	0	CHOFU MARU	
JDWX	32 32	0	KOFU MARU	
JFDG	121 121	0	SHUMPU MARU	

CALL SIGN	TOTAL	BATHY	TESAC	SHIPNAME
JFPQ	85 85	0	KASHIMASAN MARU	
JGZK	159 159	0	RYOFU MARU	
JITV	75 75	0	WELLINGTON MARU	
JIVB	71 71	0	SEIFU MARU	
JKCF	131 131	0	GEORGE WASHINGTON BR	
JRBM	41 41	0	***	
J8JA4	23 23	0	***	
KGJB	11 11	0	SEA-LAND DEFENDER	
KIRH	79 79	0	SEA-LAND TRADER	
KJLV	121 121	0	***	
KNFG	86 86	0	SEA WOLF	
KRGB	97 97	0	SEA-LAND ENTERPRISE	
KRHG	29 29	0	RALEIGH BAY	
LADB2	45 45	0	SKAUGRAN	
LAJV4	86 86	0	SKAUBRYN	
LDGJ	118 0	118	***	
LLZG	157 0	157	***	
LNIW	7 0	7	***	
NASW	6 6	0	***	
NAVO	296 296	0	U.S. NAVAL OCEANOGRAPH	
NAVOC	26 26	0	U.S. NAVAL OCEANOGRAPH	
NAVOCE	5 5	0	U.S. NAVAL OCEANOGRAPH	
NAV PAC	11 11	0	***	
NCSG	2 2	0	***	
NIDK	21 21	0	ICEPAT GROTON CT	
NNUD	418 418	0	SILAS BENT	
NZSK	27 27	0	***	
PAGE	5 5	0	***	
OWUO6	17 17	0	MOANA PACIFIC	
PGBE	45 45	0	***	
PGEC	12 12	0	NEDLLOYD VAN NOORT	
PGFE	28 28	0	NEDLLOYD VAN DIEMEN	
PJJU	62 62	0	OLEANDER	
RV6	252 252	0	***	
SBXF	1 1	0		
SCOU	3 3	0	TV 243	
SCPL	3 3	0	***	
SEXQ	1 1			
SCPI	1 1	0		
SEYD	5 5	0	TV 274	
SHIP	1063 1035	28	***	
SKVP	1 1	0		
6FK	75 75	0	SWAN REEFER	
TFEA	72 72	0	BJARNI SAEMUNDSSON	
UQHM	0 35	35		
UZFA	0 1	1		
UFJN	0 36	36		
TFVD	21 21	0	***	
VC9450	410 9	409	GADUS ATLANTICA	
VJBQ	49 49	0	ANRO AUSTRALIA	
VJDP	109 109	0	IRON PACIFIC	
VKCN	12 12	0		
VKLC	48 48	0	BRISBANE	



## April, May and June 1994

CALL SIGN	TOTAL	BATHY	TESAC	SHIPNAME
VKLP	50 50	0		HMAS MELBOURNE
VKML	46 46	0		
VKMK	1 1	0		
VLNC	58 58	0		
VLNB	28 280			TORRENS
VSBI3	108 108	0		BIBI
V2QT	44 44	0		***
WPGK	69 69	0		SEA-LAND NAVIGATOR
WSRL	105 105	0		SEA-LAND PACIFIC
WTDF	1 1	0		
WTDK	6 6	0		
WTED	2 2	0		
WTDN	31 31	0		MILLER FREEMAN
WTDO	58 57	1		OREGON II
WTED	2 2	0		
WTER	79 13	56		MALCOLM BALDRIGE
WTES	64 64	0		SURVEYOR
WVFX	14 14	0		PRESIDENT MCKINLEY
YDLR	37 37	0		BOGASARI LIMA
Y3CH	20 0	20		
ZCAQ9	212 212	0		WEST MOOR
ZCKP	44 44	0		STAR DRIVANGER
ZCKU	14 14	0		STAR DROTTANGER
ZDAZ6	101 101	0		T A EXPLORER
ZEOD				PISCES PIONEER
ZMFS	18 18	0		WELLINGTON
3EET4	41 41	0		SEAS EIFFEL
3EFY6	2 2	0		
3EJT9	102 102	0		***
3ETQ5	154 154	0		***
3EVS	46 46	0		SOUTH ISLANDER
9VUU	29 29	0		ANRO ASIA
9VVB	65 65	0		GOLDENSARI INDAH
9VWM	9 9	0		
21002	761 761	0		BUOY
21004	792 792	0		BUOY
22001	754 754	0		BUOY
32303	93 93	0		BUOY
32304	97 97	0		BUOY
32315	97 97	0		BUOY
32316	97 97	0		BUOY
32317	96 96	0		BUOY
32318	99 99	0		BUOY
32319	100 100	0		BUOY
32320	55 55	0		BUOY
32321	96 96	0		BUOY
32322	51 51	0		BUOY
43001	94 94	0		BUOY
51006	102 102	0		BUOY
51007	101 101	0		BUOY
51008	102 102	0		BUOY
51009	99 99	0		BUOY
51010	101 101	0		BUOY

CALL SIGN	TOTAL	BATHY	TESAC	SHIPNAME
51011	25 25	0		BUOY
51014	98 98	0		BUOY
51015	102 102	0		BUOY
51016	98 98	0		BUOY
51017	97 97	0		BUOY
51018	99 99	0		BUOY
51019	98 98	0		BUOY
51020	98 98	0		BUOY
51021	98 98	0		BUOY
51022	100 100	0		BUOY
51023	98 98	0		BUOY
51301	96 96	0		BUOY
51302	99 99	0		BUOY
51303	103 103	0		BUOY
51305	99 99	0		BUOY
51306	98 98	0		BUOY
51307	94 94	0		BUOY
51308	96 96	0		BUOY
51309	105 105	0		BUOY
51310	102 102	0		BUOY
52001	77 77	0		BUOY
52002	98 98	0		BUOY
52003	97 97	0		BUOY
52004	98 98	0		BUOY
52006	99 99	0		BUOY
52007	100 100	0		BUOY
52008	100 100	0		BUOY
52010	100 100	0		BUOY
52011	100 100	0		BUOY
52012	58 58	0		BUOY
52302	100 100	0		BUOY
52307	61 61	0		BUOY
52309	96 96	0		BUOY
52310	99 99	0		BUOY
52311	97 97	0		BUOY
52312	97 97	0		BUOY
52313	99 99	0		BUOY
52315	95 95	0		BUOY
52316	98 98	0		BUOY
52318	7 7	0		BUOY

TOTAL BATHYS RECEIVED 16003

TOTAL TESACS RECEIVED 1635

TOTAL REPORTS RECEIVED 17638



Wave observations are taken each hour during a 20-minute averaging period, with a sample taken every 0.67 seconds. The significant wave height is defined as the average height of the highest one-third of the waves during the average period each hour. The maximum significant wave height is the highest of those values for that month. At most stations, air temperature, water temperature, wind speed and direction are sampled once per second during an 8.0-minute averaging period each hour (moored buoys) and a 2.0-minute averaging period for fixed stations (C-MAN). Contact NDBC Data Systems Division, Bldg 1100, SSC, Mississippi 39529 or phone (601) 688-2838 for more details.

## April, May and June 1994

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA HR)	MEAN PRESS (MB)
APRIL 1994													
32302	18.0S	085.1W	0714	21.3	22.5	1.9	4.7	08 23	12.9	SE	24.5	09 03	1014.2
41001	34.7N	072.7W	0720	19.4	20.3	1.6	4.2	14 09	11.2	SW	26.4	16 23	1020.3
41002	32.3N	075.2W	0720	21.1	22.9	1.4	4.1	23 19	10.8	S	26.2	23 16	1020.4
41004	32.5N	079.1W	0711	21.5		1.1	2.7	08 19	6.1	SE	11.9	30 04	1019.1
41006	29.3N	077.3W	0719	22.5	24.5	1.4	3.4	24 06	11.6	E	20.2	24 04	1019.6
41009	28.5N	080.2W	1440	23.3	23.5	1.0	2.5	09 13	11.8	NW	22.7	07 01	1018.6
41010	28.9N	078.5W	1438	23.2	24.8	1.4	3.0	24 16	12.2	E	21.4	09 02	1019.5
41016	24.6N	076.5W	0720	24.9	25.7	0.6	1.7	11 10	13.0	E	22.7	27 23	1018.8
42001	25.9N	089.7W	0720	23.8	23.9	1.0	4.2	07 02	11.2	SE	31.3	07 00	1016.9
42002	25.9N	093.6W	0719	22.6	22.7	1.2	4.3	06 18	12.5	SE	37.7	06 14	1014.8
42003	25.9N	085.9W	0720	24.6	26.6	0.9	2.4	10 12	11.2	E	31.9	21 20	1018.0
42007	30.1N	088.8W	0719	20.4	21.5				11.4	SE	27.0	06 09	1017.8
42019	27.9N	095.0W	0720	21.1	21.7	1.2	3.3	06 11	12.2	SE	31.3	16 10	1014.8
42020	27.0N	096.5W	0719	21.5	21.3	1.3	4.3	06 11	11.6	SE	34.2	16 05	1014.0
42025	25.0N	080.5W	0720	25.1	25.4	0.6	2.1	12 07					
42035	29.3N	094.4W	0719	20.1	20.5	0.8	2.4	28 09	11.4	SE	30.7	06 10	1015.8
42036	28.5N	084.5W	0716	21.8	21.2	0.6	1.8	07 15	8.2	E	24.3	07 05	1017.8
42037	24.5N	081.4W	0720	25.0	25.3	0.7	2.3	12 07	9.1	E	20.8	30 17	
44004	38.5N	070.7W	0720	14.8	15.2	1.7	5.2	14 06	12.7	S	29.7	01 09	1018.8
44005	42.7N	068.6W	0441	6.9	5.9	1.4	3.1	14 22	12.0	SW	29.1	24 00	1015.2
44007	43.5N	070.1W	0716	6.1	4.6	0.9	2.8	05 19	11.9	SW	30.9	03 17	1016.3
44008	40.5N	069.4W	0717	8.1	5.7	1.4	4.0	14 12	12.5	SW	30.3	14 03	1018.1
44009	38.5N	074.7W	0717	10.5	9.0				10.7	S	25.8	13 21	1018.9
44011	41.1N	066.6W	0720	7.9	5.9	1.7	4.7	14 13	10.1	S	25.5	08 06	1018.3
44013	42.4N	070.7W	0720	7.0	5.0	0.6	1.7	03 16	9.8	S	29.7	17 15	1016.1
44014	36.6N	074.8W	0717	13.4	10.5	0.9	1.8	22 17	10.4	S	24.3	13 22	1019.7
44025	40.3N	073.2W	0719	8.7	7.2	1.1	2.4	07 18	11.3	S	24.9	16 14	1017.1
45002	45.3N	086.4W	0719	2.2	1.1	0.7	2.5	16 00	11.6	S	25.3	16 12	1014.3
45003	45.3N	082.8W	0452	2.7	1.2	0.8	3.2	17 01	12.9	W	30.7	16 23	1012.1
45007	42.8N	087.1W	0720	3.6	1.7	0.7	3.7	05 12	9.9	S	28.2	05 11	1014.7
45008	44.3N	082.4W	0239	3.6	1.6	0.7	2.3	27 21	9.8	NE	18.8	27 23	1016.1
46002	42.5N	130.3W	0711	10.7	11.3	2.8	9.4	25 11	13.8	NW	33.2	25 06	1018.9
46003	51.9N	155.9W	0716	3.4	4.0	2.7	6.0	12 17					1006.1
46005	46.1N	131.0W	0720	9.6	10.1	2.7	5.9	25 12	13.4	W	26.4	24 17	1016.3
46006	40.9N	137.5W	0717	11.1	11.4	3.0	8.4	25 02					
46012	37.4N	122.7W	0706	11.7		2.2	5.6	26 02	12.2	NW	25.3	27 03	1018.0
46013	38.2N	123.3W	0715	10.9	10.5	2.6	6.8	25 23	15.2	N	30.9	27 01	1016.8
46014	39.2N	124.0W	0715	11.0	10.9	2.5	6.6	26 03	14.0	NW	33.0	27 00	1018.1
46022	40.8N	124.5W	0718	11.0	11.3	2.6	7.0	25 23	12.3	N	29.9	27 12	1018.5
46025	33.8N	119.1W	0702	13.9	14.3	1.3	2.7	24 23	7.8	W	25.8	10 01	1015.2
46026	37.8N	122.7W	0718	11.5	11.2	2.0	5.3	26 06	12.4	NW	24.3	03 10	1017.5
46027	41.9N	124.4W	0718	10.4	10.3	2.3	6.3	25 22	12.4	N	32.4	25 05	1018.0
46028	35.8N	121.9W	0572	12.3	13.2	2.3	6.7	26 10	15.4	NW	26.6	20 06	1016.5
46029	46.2N	124.2W	0720	11.1	10.6	2.3	4.8	08 09	10.6	NW	28.8	08 08	1018.0
46030	40.4N	124.5W	0551	10.4		2.1	4.1	03 17	12.3	N	25.3	03 13	1019.1
46035	57.0N	177.7W	0718	-1.4	1.7	2.1	3.4	01 09	14.4	NE	33.6	11 08	1014.1
46041	47.4N	124.5W	0715	9.6	11.0	2.1	3.9	06 18	10.5	NW	28.0	08 20	1017.2
46042	36.8N	122.4W	0714	11.9	12.5	2.4	6.7	26 06	13.7	NW	27.6	24 12	1018.2
46045	33.8N	118.5W	0451	14.5	15.2	1.0	2.4	10 01	6.7	W	23.3	09 05	1016.1
46050	44.6N	124.5W	0720	10.2	11.1	2.4	5.6	25 23	11.2	N	32.8	08 18	1017.4
46051	34.5N	120.7W	0718	12.4					13.9	NW	24.9	19 04	1017.2
46053	34.2N	119.9W	0720	13.1	12.6	1.4	2.7	02 12	11.2	W	29.5	09 21	1015.3
46054	34.3N	120.5W	0717	12.4	12.0	2.1	4.8	26 12	17.4	NW	31.7	19 04	1016.7
51002	17.2N	157.8W	0719	24.7	25.2	2.7	4.2	22 11	17.6	E	26.5	21 02	1016.1
51003	19.1N	160.8W	0720	23.8	24.9	2.5	4.3	01 04	13.9	NE	23.1	12 16	1016.7
51004	17.4N	152.5W	0720	24.0	24.8	2.6	4.3	06 12	16.8	NE	25.0	20 19	1017.3
51026	21.4N	157.0W	0719	22.6	23.5	2.5	4.5	01 00	16.7	E	24.7	21 01	1018.7
52009	13.7N	144.7E	0250			1.3	2.2	01 07	11.0	E	22.7	01 16	1010.1
91222	18.1N	145.8E	0701	26.7					7.1	E	15.7	24 09	1012.2
91251	11.4N	162.4E	0713	27.2					15.1	E	32.5	19 17	1010.0
91328	8.6N	149.7E	0715	27.8					7.2	NE	15.2	16 01	1010.1
91338	5.3N	153.7E	0718	28.2					5.7	NE	20.8	29 03	1008.4
91343	7.6N	155.2E	0717	27.8					10.5	NE	21.2	30 02	1008.8
91352	6.2N	160.7E	0461	27.7					9.1	NE	20.1	18 13	1010.2
91355	5.4N	163.0E	0716	27.2					6.5	E	18.7	30 00	1008.3
91377	6.1N	172.1E	0717	27.3					11.3	NE	27.6	03 16	1010.7



## April, May and June 1994

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA HR)	MEAN PRESS (MB)
ABAN6	44.3N	075.9W	0719	6.2	2.0				4.5	S	24.3	03 03	1015.5
ALSN6	40.5N	073.8W	0707	10.2	7.0	0.8	1.7	03 14	15.2	S	38.6	16 15	1017.5
BURL1	28.9N	089.4W	0718	20.1					11.1	SE	39.5	06 20	1017.7
CARO3	43.3N	124.4W	0718	10.1					10.8	N	28.7	24 22	1018.4
CHLV2	36.9N	075.7W	0720	14.1	12.0	0.8	1.8	22 16	16.3	S	32.3	13 23	1019.0
CLKN7	34.6N	076.5W	0720	18.4					10.6	SW	28.9	22 16	1020.3
CSBF1	29.7N	085.4W	0716	20.7					6.4	SE	17.2	01 00	1018.5
DBLN6	42.5N	079.4W	0720	7.0					11.5	SW	34.9	16 18	1016.7
DESW1	47.7N	124.5W	0718	9.6					12.1	NW	37.9	08 22	1017.1
DISW3	47.1N	090.7W	0719	3.2					14.2	NE	38.4	26 22	1014.3
DPIA1	30.3N	088.1W	0716	20.0	21.3				11.3	SE	25.9	06 21	1018.5
DRYF1	24.6N	082.9W	0719	24.1					9.0	E	21.4	29 05	1017.3
DSLN7	35.2N	075.3W	0720	19.0	20.2	1.2	3.8	23 07	16.6	W	41.1	13 22	1020.4
FBIS1	32.7N	079.9W	0720	20.2					9.0	S	23.8	08 17	1020.0
FFIA2	57.3N	133.6W	0720	6.3					9.0	N	33.6	15 05	1012.1
FPSN7	33.5N	077.6W	0706	20.0		1.1	2.8	13 20	13.1	SW	32.7	14 03	1019.8
FWYF1	25.6N	080.1W	0719	24.9	25.6				12.8	E	27.0	09 14	1018.1
GDIL1	29.3N	090.0W	0717	21.0	22.6				10.3	E	31.3	06 18	1017.4
GLLN6	43.9N	076.5W	0720	4.0					13.5	SW	29.7	03 05	1014.7
IOSN3	43.0N	070.6W	0717	7.2					14.1	S	34.0	16 18	1015.4
LKWF1	26.6N	080.0W	0720	24.3	25.1				11.8	E	28.5	22 20	1018.7
LONF1	24.9N	080.9W	0719	25.3	26.8				11.5	E	23.5	29 20	1017.4
MDRM1	44.0N	068.1W	0720	5.0					15.4	S	33.5	03 22	1015.3
MISM1	43.8N	068.9W	0718	4.8					15.1	SW	36.4	16 19	1015.5
MLRF1	25.0N	080.4W	0720	25.1	25.4				11.3	E	25.6	30 12	1017.0
NWPO3	44.6N	124.1W	0673	10.0					9.9	NW	29.9	08 18	1018.7
PILM4	48.2N	088.4W	0717	1.1					13.8	W	39.2	16 12	1015.2
PTAC1	39.0N	123.7W	0719	10.4					10.9	N	27.1	24 08	1018.1
PTAT2	27.8N	097.1W	0718	20.7	21.6				13.0	SE	35.8	06 08	1014.2
PTGC1	34.6N	120.7W	0719	11.9					15.2	N	27.7	10 00	1016.3
ROAM4	47.9N	089.3W	0719	2.0					16.0	SW	40.6	16 04	1015.2
SANF1	24.5N	081.9W	0719	24.9					11.4	E	25.4	30 18	1017.2
SAUF1	29.9N	081.3W	0718	21.1	21.4				9.0	SE	27.3	23 14	1019.5
SBIO1	41.6N	082.8W	0700	8.9					13.7	SW	32.8	16 19	1016.2
SGNW3	43.8N	087.7W	0717	6.0	7.3				13.4	S	32.5	15 17	1015.9
SISW1	48.3N	122.9W	0720	9.4					10.4	W	32.4	03 23	1016.5
SMKF1	24.6N	081.1W	0720	25.4	26.0				12.4	E	26.8	30 13	1017.7
SPGF1	26.7N	079.0W	0720	24.4	26.2				8.9	E	25.4	09 12	1019.0
SRST2	29.7N	094.1W	0682	20.1					12.0	SE	27.5	28 08	1016.4
STDMA	47.2N	087.2W	0720	1.6					16.6	W	45.6	16 10	1013.4
SUPN6	44.5N	075.8W	0719	5.9	2.3				11.0	SW	33.8	03 04	1014.4
SVLS1	32.0N	080.7W	0715		20.6	0.7	2.3	09 02	11.4	S	28.8	09 02	1019.8
THIN6	44.3N	076.0W	0720	6.0									
TPLM2	38.9N	076.4W	0719	14.0	11.5				12.0	S	28.8	27 20	1018.0
TTIW1	48.4N	124.7W	0719	9.0					11.7	W	30.5	14 22	1017.1
VENF1	27.1N	082.5W	0436	23.7	26.5				7.7	E	17.0	29 15	1017.8
WPOW1	47.7N	122.4W	0719	10.2					7.4	S	29.4	06 14	1016.9
MAY 1994													
32302	18.0S	085.1W	0741	20.7	22.0	2.3	4.2	16 04	11.4	SE	19.2	10 07	1015.0
41001	34.7N	072.7W	0738	20.7	22.7	1.9	3.6	21 03	14.1	SW	26.4	22 09	1014.4
41002	32.3N	075.2W	0738	22.6	24.4	1.6	3.2	21 07	12.8	SW	22.9	03 22	1014.5
41004	32.5N	079.1W	0740	19.0		1.2	2.9	20 11	12.6	SW	26.4	20 11	1014.1
41006	29.3N	077.3W	0737	24.1	25.4	1.4	3.6	21 13	9.7	E	24.1	20 20	1014.7
41009	28.5N	080.2W	1479	24.8	25.9	0.9	2.7	21 09	9.9	SE	27.2	19 21	1014.5
41010	28.9N	078.5W	1479	24.7	25.9	1.3	3.3	21 14	9.3	SE	25.6	19 20	1014.9
41016	24.6N	076.5W	0740	26.3	27.3	0.3	1.5	08 01	8.5	E	21.2	07 23	1015.3
42001	25.9N	089.7W	0742	26.0	26.5	0.6	2.4	21 06	8.9	SE	19.2	20 22	1014.9
42002	25.9N	093.6W	0738	25.8	26.3	0.8	2.1	14 16	11.4	SE	28.6	14 12	1013.8
42003	25.9N	085.9W	0738		27.6	0.5	2.2	20 13	8.4	E	23.5	20 18	1015.6
42007	30.1N	088.8W	0738	24.1	25.8				10.4	SW	25.1	19 10	1015.2
42019	27.9N	095.0W	0739	24.8	25.3	1.0	2.2	14 10	10.2	SE	26.8	14 07	1013.6
42020	27.0N	096.5W	0740	25.5	25.4	1.1	2.9	14 19	11.7	SE	29.9	15 10	1013.0
42025	25.0N	080.5W	0739	26.4	27.5	0.3	1.6	26 12					
42035	29.3N	094.4W	0735	24.5	25.7	0.7	2.2	14 11	10.6	SE	29.5	14 08	1014.4
42036	28.5N	084.5W	0740	25.0	24.8	0.5	2.5	20 03	7.6	W	23.3	20 03	1014.6
42037	24.5N	081.4W	0740	26.5	27.3	0.4	1.6	26 06	6.8	E	18.3	26 02	1015.6
44004	38.5N	070.7W	0737	14.9	15.4	1.8	5.0	05 01	12.5	S	35.2	05 00	1013.7
44005	42.9N	069.0W	0737	8.4	7.2	1.5	4.7	06 00	13.3	S	34.6	05 13	1012.0
44007	43.5N	070.1W	0737	8.9	7.5	0.9	3.6	05 20	10.1	S	28.8	05 18	1011.3
44008	40.5N	069.4W	0738	9.6	7.6	1.5	4.8	05 09	12.0	SW	30.1	05 06	1012.9
44009	38.5N	074.7W	0732	13.4	12.7				11.9	S	30.3	04 22	1015.2
44011	41.1N	066.6W	0738	10.1	8.4	1.8	6.4	05 15	10.6	SW	28.6	05 14	1012.6
44013	42.4N	070.7W	0738	10.2	8.7	0.8	3.7	05 17	10.5	W	29.9	05 16	1011.9
44014	36.6N	074.8W	0736	15.2		1.4	4.9	04 17	11.9	N	29.7	04 14	1015.3
44025	40.3N	073.2W	0741	12.1	11.2	1.5	3.4	05 06	11.3	S	26.6	05 05	1013.2
45001	48.1N	087.8W	0654	3.8	2.0	0.5	1.6	14 09	9.0	SE	23.3	30 23	1014.2
45002	45.3N	086.4W	0734	4.8	2.4	0.5	2.5	11 11	9.0	S	25.5	11 10	1015.6
45003	45.3N	082.8W	0730	4.2	2.1	0.5	1.9	12 03	9.0	NW	24.3	11 14	1014.7
45004	47.6N	086.5W	0668	3.4	1.7	0.5	2.2	16 03	9.3	SE	24.3	16 01	1015.1
45005	41.7N	082.4W	0551	12.4	11.0	0.5	1.8	26 23	8.7	S	25.1	26 17	1015.0
45006	47.3N	089.9W	0693	5.0	2.5	0.5	1.6	08 19	7.1	NE	18.2	25 17	1014.9



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45007	42.8N	087.1W	0738	5.2	2.6	0.4	2.8	26 16	7.8	S	26.6	26 12	1016.8
45008	44.3N	082.4W	0737	5.0	2.5	0.6	3.0	16 21	8.5	NW	28.2	26 11	1014.9
45010	43.0N	087.8W	0359	11.1	9.4	0.5	2.5	26 15	8.3	N	23.1	26 14	1016.4
46001	56.3N	148.2W	0093	6.7	7.3	1.6	2.3	28 18	9.9	SE	15.9	31 11	1003.9
46002	42.5N	130.3W	0733	11.8	12.7	2.4	4.6	15 12	12.5	NW	25.5	15 15	1008.9
46003	51.9N	155.9W	0735	4.8	4.9	2.7	6.4	21 00	12.2	W	21.6	27 12	1003.1
46005	46.1N	131.0W	0739	10.6	11.3	2.5	5.5	31 13	13.3	NW	26.2	29 06	1017.4
46006	40.9N	137.5W	0737	11.9	12.4	2.6	4.8	31 10	14.3	W	23.9	30 19	1022.8
46012	37.4N	122.7W	0725	11.9		2.1	4.4	26 15	11.1	NW	29.0	13 05	1016.2
46013	38.2N	123.3W	0738	11.0	9.9	2.4	4.7	26 12	15.8	N	33.2	13 04	1014.6
46014	39.2N	124.0W	0734	11.4	10.6	2.2	4.2	26 01	13.1	NW	30.5	26 00	1016.2
46022	40.8N	124.5W	0736	12.0	11.9	2.1	4.6	27 07	10.9	N	27.2	26 11	1016.9
46025	33.8N	119.1W	0716	14.5	15.4	1.0	2.3	17 01	6.0	W	21.2	17 00	1014.2
46026	37.8N	122.8W	0737	12.0	10.8	1.9	4.1	26 02	12.2	NW	29.1	13 03	1015.5
46027	41.9N	124.4W	0737	11.0	10.3	2.0	4.0	26 02	9.6	NW	33.0	26 00	1016.4
46028	35.8N	121.9W	0738	12.7	13.0	2.3	4.7	13 23	15.7	NW	28.8	13 22	1015.6
46029	46.2N	124.2W	0741	13.2	12.3	2.0	4.6	29 01	9.8	N	27.1	28 20	1016.9
46035	57.0N	177.7W	0738	0.6	2.4				12.4	N	26.8	22 09	1009.2
46041	47.4N	124.5W	0735	11.4	12.4	1.8	3.9	28 22	8.9	NW	25.3	28 21	1016.5
46042	36.8N	122.4W	0740	12.2	12.5	2.2	4.2	26 16	13.1	NW	26.0	13 20	
46045	33.8N	118.5W	0467	15.2	16.3	0.9	2.2	17 04	6.3	W	17.3	17 01	1014.0
46050	44.6N	124.5W	0740	12.0	12.7	2.1	4.1	30 08	10.9	N	25.3	04 02	1016.0
46051	34.5N	120.7W	0737	12.3	11.8				12.9	NW	24.1	02 02	1015.7
46053	34.2N	119.9W	0742	13.4	13.6	1.1	2.4	13 20	8.4	W	28.4	16 22	1014.1
46054	34.3N	120.5W	0740	12.5	12.5	2.0	3.8	13 22	16.3	NW	30.5	03 09	1015.3
51002	17.2N	157.8W	0740	25.0	25.2	2.4	3.7	27 18	17.8	E	24.5	28 04	1015.6
51003	19.1N	160.8W	0738	24.7	25.7	2.0	3.5	28 05	11.7	E	20.5	27 16	1015.9
51004	17.4N	152.5W	0741	24.6	25.3	2.4	3.6	16 22	17.0	NE	24.3	27 17	1016.9
51026	21.4N	157.0W	0738	23.6	24.3	2.1	2.6	07 20	16.3	E	25.1	27 13	1017.8
91222	18.1N	145.8E	0647	27.8					7.7	E	20.5	07 05	1011.5
91251	11.4N	162.4E	0737	27.6					15.3	E	23.7	06 13	1010.1
91328	8.6N	149.7E	0741	27.9					7.6	NE	22.9	12 13	1010.1
91338	5.3N	153.7E	0736	27.9					6.3	NE	25.8	24 03	1008.3
91343	7.6N	155.2E	0738	28.1					11.3	NE	24.8	07 21	1008.7
91355	5.4N	163.0E	0738	27.2					6.2	E	22.1	16 02	1008.4
91377	6.1N	172.1E	0737	27.1					9.9	NE	25.2	04 23	1011.0
ABAN6	44.3N	075.9W	0741	10.6	6.9				3.9	S	20.9	26 15	1013.4
ALSN6	40.5N	073.8W	0740	13.2	11.5	0.9	2.9	05 17	14.9	S	35.4	30 21	1013.5
BURL1	28.9N	089.4W	0735	23.9					7.7	NE	27.2	30 11	1015.5
CARO3	43.3N	124.4W	0738	11.6					8.6	N	28.4	15 20	1016.9
CHLV2	36.9N	075.7W	0739	15.7	15.3	1.0	4.2	05 00	15.1	N	38.9	04 14	1015.1
CLKN7	34.6N	076.5W	0739	19.4					12.7	SW	27.8	02 13	1015.6
CSBF1	29.7N	085.4W	0736	23.6					6.8	W	17.0	08 18	1015.5
DBLN6	42.5N	079.4W	0739	10.6					11.0	SW	30.8	11 23	1015.6
DESW1	47.7N	124.5W	0738	11.4					10.5	NW	37.3	28 21	1016.4
DISW3	47.1N	090.7W	0740	8.1					9.6	NE	29.0	30 22	1015.2
DP1A1	30.3N	088.1W	0736	23.7	25.6				9.4	NE	23.8	19 11	1015.7
DRYF1	24.6N	082.9W	0738	26.3					8.0	NE	34.6	19 10	1014.5
DSLW7	35.2N	075.3W	0740	19.1	21.7	1.6	3.6	21 01	18.8	NE	37.8	08 03	1015.5
FBIS1	32.7N	079.9W	0740	21.3					10.6	SW	24.6	13 15	1015.3
FFIA2	57.3N	133.6W	0737	8.5					8.9	SE	28.0	09 02	1013.3
FPSN7	33.5N	077.6W	0713	20.9	1.4		2.9	21 21	17.4	SW	33.5	04 01	1014.8
FWYF1	25.6N	080.1W	0740	26.2	27.4				10.3	E	23.8	25 16	1014.8
GDLL1	29.3N	090.0W	0735	24.7	26.8				8.4	S	20.4	01 00	1015.0
GLLN6	43.9N	076.5W	0740	8.1					11.9	SW	28.7	01 18	1012.7
IOSN3	43.0N	070.6W	0740	10.2					13.5	W	34.9	13 20	1011.4
LKNW1	26.6N	080.0W	0731	25.4	27.1				8.9	E	29.7	20 19	1015.0
LONF1	24.9N	080.9W	0739	26.5	28.6				8.7	E	27.8	19 11	1014.3
MDRM1	44.0N	068.1W	0740	7.6					15.2	S	41.2	05 19	1011.2
MISM1	43.8N	068.9W	0736	7.5					14.9	SW	40.9	05 18	1011.5
MLRF1	25.0N	080.4W	0740	26.4	27.5				8.9	E	26.0	19 00	1013.8
NWPO3	44.6N	124.1W	0320	11.2					8.8	NW	28.2	29 00	1018.4
PILM4	48.2N	088.4W	0740	4.6					10.8	W	30.1	08 18	1015.9
PTAC1	39.0N	123.7W	0738	10.9					10.8	N	24.1	26 09	1016.2
PTAT2	27.8N	097.1W	0736	24.8	25.9				12.6	SE	36.5	14 05	1013.1
PTGC1	34.6N	120.7W	0741	11.8					14.7	N	27.1	12 04	1014.8
ROAM4	47.9N	089.3W	0739	6.8					12.2	NE	36.4	09 04	1016.0
SANF1	24.5N	081.9W	0737	26.4	27.3				8.5	E	30.5	19 12	1014.4
SAUF1	29.9N	081.3W	0737	23.2	24.8				10.0	NE	31.5	20 06	1015.1
SBI01	41.6N	082.8W	0525	11.8					11.1	SW	32.3	12 01	1017.2
SGNW3	43.8N	087.7W	0736	11.2	11.3				10.9	S	29.0	11 14	1017.2
SISW1	48.3N	122.9W	0740	11.1					9.4	SW	33.2	28 22	1015.8
SMKF1	24.6N	081.1W	0739	26.8	27.9				8.9	E	26.7	05 10	1014.7
SPGF1	26.7N	079.0W	0739	25.8	27.7				5.6	E	16.8	20 16	1015.1
SRST2	29.7N	094.1W	0500	24.0					11.1	S	34.7	14 10	1014.7
STDM4	47.2N	087.2W	0740	6.8					15.2	NW	35.7	14 14	1014.7
SUPN6	44.5N	075.8W	0740	10.7	7.8				9.5	SW	30.6	31 20	1012.5
SVLS1	32.0N	080.7W	0736	23.5	0.9		2.1	03 04	14.7	NE	31.7	20 12	1015.1
THIN6	44.3N	076.0W	0740	10.3									
TPLM2	38.9N	076.4W	0739	15.8	15.9				12.2	S	29.9	17 00	1015.1
TTIW1	48.4N	124.7W	0739	10.8					10.3	SW	32.2	04 08	1016.7
VENF1	27.1N	082.5W	0736	24.5	26.8				8.1	NW	23.2	21 21	1015.2
WPOW1	47.7N	122.4W	0739	12.4					5.4	S	23.1	28 23	1016.0



## April, May and June 1994

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA HR)	MEAN PRESS (MB)
JUNE 1994													
32302	18.0S	085.1W	0720	19.7	20.9	2.5	5.6	18 14	14.2	SE	21.0	24 13	1016.6
41001	34.7N	072.7W	0720	24.1	24.5	1.4	3.3	25 04	10.9	SW	21.6	25 03	1017.2
41002	32.3N	075.2W	0720	25.3	26.0	1.2	2.8	08 23	11.2	SW	24.3	23 17	1016.8
41004	32.5N	079.1W	0699	26.1	26.0	1.0	2.6	24 06	10.4	SW	27.0	25 20	1016.0
41006	29.3N	077.3W	0720	26.5	27.1	0.9	1.8	09 07	8.8	S	22.2	08 02	1017.2
41009	28.5N	080.2W	1439	26.8	27.7	0.5	1.1	01 06	8.4	S	29.3	25 22	1016.9
41010	28.9N	078.5W	1440	26.8	27.3	0.9	1.7	08 22	8.2	S	25.6	26 01	1017.4
41016	24.6N	076.5W	0720	27.9	28.7	0.4	1.3	27 17	9.2	SE	21.8	28 12	1018.3
42001	25.9N	089.7W	0720	27.5	28.0	0.8	1.9	24 17	10.9	SE	22.5	06 10	1016.3
42002	25.9N	093.6W	0718	27.9	28.6	0.9	2.0	13 14	11.1	SE	24.3	11 09	1013.9
42003	25.9N	085.9W	0718		28.6	0.8	2.0	08 18	8.2	SE	15.2	01 07	1017.2
42007	30.1N	088.8W	0718	26.7	28.0				11.4	SW	28.0	23 15	1015.0
42019	27.9N	095.0W	0716	27.5	28.1	1.0	2.1	15 06	10.0	SE	20.4	02 16	1013.2
42020	27.0N	096.5W	0719	27.9	27.9	1.1	2.3	13 10	11.6	SE	27.4	12 18	1012.7
42035	29.3N	094.4W	0719	27.3	28.2	0.8	1.7	27 07	10.7	S	30.7	18 20	1013.7
42036	28.5N	084.5W	0719	27.4	26.9	0.6	1.6	07 10	7.6	S	18.5	19 19	1017.0
42037	24.5N	081.4W	0719	28.1	28.5	0.4	1.3	26 17	6.9	E	17.7	30 23	1016.8
44004	34.5N	070.7W	0645	21.8	21.8	1.0	2.4	01 17	10.6	SW	27.6	27 15	1016.2
44005	42.9N	069.0W	0719	13.9	12.0	1.0	2.5	07 05	11.1	S	25.6	28 14	1013.8
44007	43.5N	070.2W	0720	14.5	12.2	0.7	2.0	01 00	8.6	S	22.9	21 19	1012.0
44008	40.5N	069.4W	0717	15.3	12.7	1.0	3.3	30 04	8.5	S	26.8	30 00	1015.5
44009	38.5N	074.7W	0719	20.3	19.2	0.8	3.0	27 19	10.0	S	29.7	27 18	1015.6
44011	41.1N	066.6W	0720	14.6	11.9	1.3	3.4	07 18	8.1	S	19.2	07 13	1016.0
44013	42.4N	070.7W	0719	15.9	13.5	0.4	1.2	28 07	8.8	S	21.0	01 01	1013.3
44014	36.6N	074.8W	0719	22.8		0.9	2.8	27 21	9.7	S	32.3	29 15	1016.2
44025	40.3N	073.2W	0717	19.4	18.2	0.9	3.5	27 23	11.1	S	29.9	27 22	1014.0
45001	48.1N	087.8W	0713	5.6	3.1	0.4	3.4	14 23	7.6	SW	30.7	14 19	1013.0
45002	45.3N	086.4W	0716	10.1	7.6	0.4	1.7	15 07	7.8	S	23.1	29 22	1013.3
45003	45.3N	082.8W	0719	7.0	3.4	0.4	1.5	01 18	7.8	N	22.2	01 20	1013.1
45004	47.6N	086.5W	0718	5.2	2.8	0.4	2.2	14 21	7.4	SE	28.0	14 19	1013.9
45005	41.7N	082.4W	0719	19.1	18.6	0.5	1.8	25 16	8.3	NE	25.8	25 16	1013.0
45006	47.3N	089.9W	0718	7.0	3.6	0.4	1.6	15 01	6.1	SW	18.2	14 13	1013.0
45007	42.8N	087.1W	0719	11.1	7.5	0.5	1.8	24 12	7.2	S	20.8	24 10	1013.8
45008	44.3N	082.4W	0720	10.7	7.9	0.5	2.0	24 22	7.4	S	22.3	24 21	1013.1
45010	43.0N	087.8W	0720	15.2	13.6	0.5	2.4	08 04	7.9	N	25.1	08 05	1013.4
46001	56.3N	148.2W	0717	9.2	9.3	1.3	2.8	25 06	9.9	SW	22.5	25 06	1013.7
46002	42.5N	130.3W	0711	13.1	14.4	1.8	5.7	13 09	11.6	NW	27.6	13 00	1021.0
46003	51.9N	155.9W	0717	7.1	7.1	1.6	3.5	07 03	11.1	W	21.6	14 09	1014.7
46005	46.1N	131.0W	0720	11.7	12.2	1.8	8.6	13 04	11.0	W	32.4	12 19	1019.4
46006	40.9N	137.5W	0714	12.9	13.8	1.7	4.5	12 21	10.5	NW	26.0	12 13	1024.0
46012	37.4N	122.7W	0710	12.1		1.7	4.0	15 03	12.1	NW	27.2	15 03	1016.9
46013	38.2N	123.3W	0715	11.1	9.4	2.0	4.2	14 09	17.7	N	30.3	25 00	1015.3
46014	39.2N	124.0W	0712	11.7	10.5	2.0	4.0	14 06	14.3	NW	27.6	15 02	1017.3
46022	40.8N	124.5W	0714	12.8	12.5	1.6	4.2	14 00	11.0	N	22.5	28 11	1018.6
46023	34.3N	120.7W	0365	12.7	13.3	2.4	3.6	15 19	20.1	NW	25.5	28 06	1014.7
46025	33.8N	119.1W	0667	17.0	18.5	1.0	1.8	06 05	5.6	W	16.3	01 03	1012.0
46026	37.8N	122.8W	0715	19.2	10.5	1.6	3.5	15 01	12.3	NW	27.2	15 02	1016.0
46027	41.9N	124.4W	0713	11.2	9.9	1.6	4.8	14 03	8.3	NW	28.0	10 01	1018.2
46028	35.8N	121.9W	0717	12.3	11.7	2.3	4.6	15 01	20.5	NW	31.7	14 05	1015.0
46029	46.2N	124.2W	0719	14.7	13.9	1.6	5.9	13 19	9.8	N	30.6	13 01	1018.9
46035	57.0N	177.7W	0714	5.5	5.1	1.3	3.1	30 05	12.3	N	27.4	05 15	1013.9
46041	47.4N	124.5W	0715	12.8	14.1	1.4	6.3	14 00	8.8	NW	28.0	13 01	1018.2
46042	36.8N	122.4W	0713	12.2	12.1	1.8	3.5	14 20	15.8	NW	28.6	08 23	1015.7
46045	33.8N	118.5W	0715	17.5	18.7	0.9	1.5	06 05	5.7	SW	16.9	01 01	1012.7
46050	44.6N	124.5W	0719	13.5	14.0	1.6	5.8	13 16	10.7	N	27.0	13 01	1018.1
46051	34.5N	120.7W	0715	12.2	11.6				17.0	NW	26.4	29 05	1014.6
46053	34.2N	119.9W	0719	14.9	15.2	1.2	2.2	16 00	10.2	W	27.6	07 00	1012.5
46054	34.3N	120.5W	0720	12.7	13.0	2.1	3.4	15 10	22.1	NW	32.4	03 04	1013.7
51001	23.4N	162.3W	0341	25.0	25.2	1.7	2.3	15 08	13.7	E	21.1	06 00	1019.1
51002	17.2N	157.8W	0719	25.6	25.9	2.2	3.2	30 04	17.1	E	23.5	30 00	1014.9
51003	19.1N	160.8W	0719	25.4	26.1	2.0	2.7	27 03	12.6	E	21.8	27 03	1015.2
51004	17.4N	152.5W	0718	25.0	25.7	2.1	3.0	29 07	16.0	NE	22.5	29 05	1016.1
51026	21.4N	157.0W	0713	24.1	24.8				16.8	E	23.1	26 15	1017.2
91222	18.1N	145.8E	0664	28.6					6.3	E	19.5	29 20	1011.1
91251	11.4N	162.4E	0715	27.9					13.9	E	25.6	30 14	1009.3
91328	8.6N	149.7E	0719	28.0					6.1	NE	16.0	10 02	1009.9
91338	5.3N	153.7E	0717	28.0					4.5	NE	22.7	24 14	1008.2
91343	7.6N	155.2E	0717	27.8					7.9	NE	24.5	08 13	1008.4
91352	6.2N	160.7E	0218	27.7					3.1	SW	8.0	26 17	1009.2
91355	5.4N	163.0E	0717	27.1					5.1	E	17.8	27 21	1008.1
91377	6.1N	172.1E	0713	27.3					7.1	NE	22.7	06 19	1010.6
ABAN6	44.3N	075.9W	0575	18.7	13.9				3.2	S	14.9	25 15	1012.3
ALSN6	40.5N	073.8W	0720	19.6	17.0	0.8	2.3	27 22	15.3	S	37.9	27 21	1014.1
BURL1	28.9N	089.4W	0718	26.9					10.9	S	30.4	25 12	1015.5
CAR03	43.3N	124.4W	0719	12.6					8.5	N	28.1	13 07	1019.1
CHLV2	36.9N	075.7W	0720	22.7	21.5	0.7	1.7	27 18	12.4	S	35.0	22 03	1015.4
CLKN7	34.6N	076.5W	0720	25.2					10.5	SW	31.8	30 13	1016.5
CSBF1	29.7N	085.4W	0718	26.3					8.5	SW	25.3	25 14	1016.5
DBLN6	42.5N	079.4W	0720	18.5					8.6	SW	25.8	02 21	1014.1
DESW1	47.7N	124.5W	0714	12.9					10.4	NW	43.1	13 03	1018.1
DISW3	47.1N	090.7W	0657	12.8					8.1	E	39.8	14 13	1013.1



## April, May and June 1994

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
DPIA1	30.3N	088.1W	0715	26.5	28.1				9.1	SW	25.1	06/13	1015.8
DRYF1	24.6N	082.9W	0717	28.3					7.7	E	22.6	29/19	1016.8
DSLX7	35.2N	075.3W	0718	25.0	25.5				14.1	SW	35.6	25/04	1016.8
FBI51	32.7N	079.9W	0718	25.8					8.9	SW	26.1	26/22	1016.1
FFIA2	57.3N	133.6W	0715	11.4					6.8	S	28.1	01/11	1014.8
FPSN7	33.5N	077.6W	0719	25.4		1.1	2.5	25/11	14.1	SW	37.6	25/23	1015.9
FWYF1	25.6N	080.1W	0502	27.8	28.4				8.7	E	26.5	20/22	1017.3
GDIL1	29.3N	090.0W	0683	27.3	29.3				9.1	S	28.5	24/16	1014.9
GLLN6	43.9N	076.5W	0719	15.2					10.5	SW	26.2	02/13	1011.9
IOSN3	43.0N	070.6W	0714	16.8					13.1	S	31.9	21/19	1012.6
LKWF1	26.6N	080.0W	0609	27.3	28.2				8.0	E	22.3	08/22	1017.9
LONF1	24.9N	080.9W	0719	28.5	30.7				8.5	E	19.6	26/16	1016.9
MDRM1	44.0N	068.1W	0720	12.6					14.4	S	32.6	01/02	1012.9
MISM1	43.8N	068.9W	0720	13.0					14.8	S	32.6	07/05	1012.8
MLRF1	25.0N	080.4W	0720	28.2	28.8				8.5	SE	20.2	29/18	1016.5
NWFO3	44.6N	124.1W	0716	12.6					8.5	NW	29.0	13/04	1018.7
PTLM4	48.2N	088.4W	0715	6.4					10.1	W	41.9	14/16	1013.3
PTAC1	39.0N	123.7W	0694	11.2					11.6	N	25.3	26/12	1017.2
PTAT2	27.8N	097.1W	0717	27.3	28.3				12.1	SE	23.0	15/14	1012.6
PTOC1	34.6N	120.7W	0716	10.7					19.8	N	32.6	13/00	1013.7
ROAM4	47.9N	089.3W	0696	11.7	6.5				11.8	NE	40.6	14/19	1014.3
SANF1	24.5N	081.9W	0718	28.2	28.8				8.4	E	26.6	30/04	1016.8
SAUF1	29.9N	081.3W	0693	25.3	26.7				6.9	SW	21.6	29/01	1017.2
SBOI1	41.6N	082.8W	0704	20.8					8.8	E	33.3	25/16	1013.2
SGRW3	43.8N	087.7W	0720	17.9	12.5				9.5	S	26.8	08/07	1014.4
SISW1	48.3N	122.9W	0718	11.8					8.9	SW	34.0	13/06	1017.4
SMKF1	24.6N	081.1W	0719	28.7	29.3				8.7	E	21.0	30/10	1017.2
SPGF1	26.7N	079.0W	0586	27.5	29.1				4.1	S	16.9	22/23	1017.7
STDN4	47.2N	087.2W	0720	11.5					13.5	SE	44.2	14/21	1012.9
SUPN6	44.5N	075.8W	0691	18.1	14.4				7.8	SW	26.0	26/17	1012.3
SVLS1	32.0N	080.7W	0715		27.0	0.6	1.7	24/12	11.9	SW	28.2	25/03	1016.2
THIN6	44.3N	076.0W	0714	17.5									
TPLM2	38.9N	076.4W	0720	23.3	23.1				10.9	S	28.7	30/00	1014.5
TTIW1	48.4N	124.7W	0718	12.1					9.5	SW	34.9	13/06	1018.4
VENF1	27.1N	082.5W	0715	26.5	29.1				7.5	E	21.7	28/22	1017.5
WFOV1	47.7N	122.4W	0718	13.6					5.6	S	25.6	14/08	1017.6

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